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Published by the Yorkshire Naturalists' Union

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To encourage this development, a long-standing member of the YNU, who wishes to remain anonymous, has most generously offered to make a donation, the income from which would finance the publication of a plate or equivalent illustration in future issues whenever possible. The editor, on behalf of the YNU, wishes to record this deep appreciation of this imaginative gesture.

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YORKSHIRE MAYFLIES

LESLIE MAGEE

Presidential Address to the Yorkshire Naturalists' Union, Doncaster, 3 December 1994

I begin this address with a quotation by the Rev. A. E. Eaton in his 1883-88 monograph on the *Ephemeridae*: "On many accounts these insects are very eligible subjects for scientific research: but so long as they are ill known, and their exact identification is a matter difficult of accomplishment, their employment in any branch of zoological learning is surrounded with disadvantages too patent to need identification." This quotation is highly significant in relation to the content of the remainder of my address.

The name *Ephemeroptera* comes from the Greek *Ephemeros*, lasting for a day; *pteron*, wing. The Germans call the insects *Eintagsfliegen*, the one day fly; the French, *Ephémère*. The common name 'mayfly' is today applied generally to all British species, notwithstanding an unsuccessful attempt in recent years to rename them dayflies. Originally, anglers applied the name 'mayfly' to the two best known and the largest species, viz. *Ephemera danica* and *E. vulgata*. The name 'mayfly' was given to the larger species of stoneflies and to the larvae known as stonefly 'creepers' and this name still applies in some parts of northern England. The habits of the stoneflies and the descriptions of the insects in angling literature are numerous and do not give rise to confusion today. The main hatch of these two species is during June, when they are greedily devoured by birds and fishes. The reason for the insects not being called 'juneflies' rather than mayflies is that during the period when the Julian calendar was in use the peak period of the hatch was towards the end of May.

History

About 2,400 years ago the Greek philosopher Aristotle wrote briefly about an animal which emerged from a river near the Black Sea. It had four wings, four feet and had a life span of only one day. It was called *Ephemeron*, i.e. one day living. About 200AD Claudius Aelianus repeated the same story with a description of catching trout or grayling in a river in Macedonia with an artificial fly made of wool and feathers. Occasional mention is made in the translations of the classics of the animal *Ephemeron*, but it is not until the 15th century that there appeared descriptions of insects which we may confidently judge to be mayflies. Julius Caesar Scaliger (1484-1558) described an aquatic insect with a split tail (two or three ends) which was almost certainly a mayfly. In 1496 Wynkyn de Worde, a pupil of Caxton, printed at Westminster *The Treatise of Fishing with an Angle*. The author is unknown but it has been attributed to Dame Juliana Berners, an Abbess of St. Albans. It is famous for the description of twelve artificial flies, copied from natural insects, and the months of the year when they were to be used. The Maure (Mulberry-coloured) Fly and the Tandy with a body of tan coloured wool and wings of the lightest feather of the mallard can be nothing but two copies of the Mayfly in different states (imago or sub-imago). These patterns, known as the Drakes, were plagiarised by generations of writers of angling books until the end of the 18th century.

The Entomologists

In 1634, a Dutchman, Outgert Cluyt (Augenius Clutius) published a book which described and illustrated (although not very well) an insect which hatched in vast numbers on the Rhine. After this date there was no doubt whatever what animal was intended by *Ephemeron*. Forty years later Jan Swammerdam published his marvellous description of the life history of the mayfly *Palingenia longicauda* under the title of 'Ephemera Vita'. This insect, which is now extinct on the Rhine, hatched in millions ('as thick as snow flakes in winter').

In 1903, Professor L. C. Miall, a former President of the Yorkshire Naturalists' Union, wrote *The Natural History of Aquatic Insects* and devoted a whole chapter to the Mayflies.

This included a translation of Swammerdam's work which described in detail the anatomy of the insects and their life cycle. In the same chapter Miall quoted the writings of Réaumur on the mayfly, taken from the 12th mémoire of his sixth volume of *The History of Insects*.

By the end of the 18th century, 16 of the now known total of 48 recognised British species had been given scientific names by entomologists, but there was another group of people working on the natural history of aquatic insects. These were the angler-naturalists, almost entirely amateurs among whom, perhaps, the best known to naturalists is Charles Cotton, because his work is included in the later editions of *The Compleat Angler* written by his friend Izaak Walton. This work, said to have been written in less than a week, was Part 2 of *The Compleat Angler* published in 1676 and was entitled 'How to angle for Trout and Grayling in a Clear Stream'. The work lists artificial flies for every month of the year and gives a description of the mayfly's short existence as a winged insect. Cotton was educated at Cambridge and lived the life of a country gentleman (albeit impoverished) at Beresford Hall, situated closed to the banks of the R. Dove in Derbyshire.

During the exuberant days after Waterloo the country came to life and there was a spate of books on all aspects of natural history, partly inspired by the writings of Gilbert White of Selborne and his contemporaries, several of whom were members of the Royal Society and who were to become members of the Linnean Society, founded in 1788. Simultaneously there appeared books on angling, shooting and hunting; the earlier works were mostly mere copies or blatant plagiarisms passed off as original works but now, with the opportunity to travel freely, came new authors. Most of the books were poorly illustrated, making identification of aquatic insects difficult.

Suddenly out of the blue in 1836 came a book that made easier identification of the common insects seen on or around water. It was the *The Fly-Fisher's Entomology* by Alfred Ronalds. The hand-coloured copperplate engravings have never been surpassed, making it possible for some species to be identified with certainty from the plates alone; moreover the scientific classifications were accurate for the period, following those of Linnaeus (although the orders and genera have in most cases been superceded).

Ronalds' observations were made on the little R. Blithe in Staffordshire where he built an observatory at the water's edge, with windows so obscured that the feeding trout were undisturbed.

There were others in Yorkshire observing and recording in detail the insects which were the food of the trout and grayling, all keen naturalists in their own way; among these were William Pilling of Pool Mill, *List of Flies for ye River Wharfe*, 1794; John Swarbrick, Farmer of Austby, *List of Wharfedale Flies*, 1807; T. C. Hofland, *The British Angler's Manual*, 1839; Michael Theakston, *A List of Natural Flies taken by Trout, Grayling and Smelt in the streams of Ripon*, 1853.

Hofland was a wealthy landscape artist who often stayed at the shooting lodge at Bolton Abbey as a guest of the Duke of Devonshire but who also travelled widely throughout the British Isles. Theakston was born at Ripon in 1786 and died there in 1866. His book is remarkable for the excellent engravings of terrestrial and aquatic insects which were drawn from life over a long period of time. The observations were made mainly on the Yore and the little R. Skell which flowed past his house in Waterskellgate.

The publication of Ronalds' work did not solve the problem of identification because the use of local and vernacular names continued until well into the 20th century; moreover they were applied to different insects in different parts of the country and the commoner the insect the more names there were. Some, like that of the Greendrake, *E. danica*, go back to the *Treatise* and there are others, such as the Primrose Dun, *Heptagenia sulphurea*, of whose identification there can be no doubt; we can obtain some idea of their distribution and abundance in the past from studies of the angling literature (Magee 1994).

The Yorkshire Entomologists

The results of the work of the Yorkshire entomologists were somewhat meagre and scattered and there was no published list of Yorkshire records. Eaton's monograph

(1833-88) referred to earlier had a few records from the North of England but none from Yorkshire. The Ephemeroptera were apparently totally neglected by the naturalists in Victorian times and no list appears in the *Victoria County History for Yorkshire* published in 1907. The first published list of Yorkshire mayflies was that of Prof. E. Percival and H. Whitehead in the *The Entomologist's Monthly Magazine* in 1927. The list appeared in the same year as the death of Geo. T. Porritt.

George T. Porritt (1848-1927) had dominated the Entomology Section of the YNU over a long period of time. He made his first contribution to *The Entomologist* in 1865 when still a youth of 17. By 1870 he was becoming a recognised authority on Yorkshire Lepidoptera and in 1872 became a Fellow of the Linnean Society. Having seen the demise of *The Naturalist* (1865-67) and the *Yorkshire Naturalists Recorder* (1872-1873), he made another bid for success in August 1875 with the launching of *The Naturalist* under the joint editorship of Charles P. Hobkirk and G. T. Porritt. Porritt's name was to appear on the title page as an assistant editor for another 51 years. He was President of the Union in 1900.

Porritt was a dedicated collector of insects and welcomed specimens from other collectors. In 1897 he made a request in *The Naturalist* for specimens of the Neuroptera and the Orthoptera but specifically excluded the Ephemeridae (sic) {Mayflies}, "which I do not propose to touch for the present". In 1920 Porritt wrote in his annual report in *The Naturalist* "Still no mayflies". Porritt's discouragement of the collecting of mayflies must have played some part in the apparent lack of interest of the entomologists in the order. As a result the two decades after his death was the period of the greatest interest and activity in the Yorkshire mayflies.

The Porritt Collection of Insects

The Porritt Collection of Macro-Lepidoptera consists of 23,000 specimens housed in 71 cabinet drawers. His collection of Neuroptera (Mayflies, Dragonflies and Caddis flies) and Orthoptera (Earwigs, Grasshoppers, Crickets and Cockroaches) comprised 16,000 specimens housed in 65 cabinet drawers. The Lepidoptera collection was purchased by subscription and is now kept at the Tolson Memorial Museum in Huddersfield, together with the Neuroptera and Orthoptera collection which was his personal bequest; it does not however contain any mayflies.

In 1925 the YNU set up a River Investigation Committee with monthly collecting from the Wharfe at Grassington and Harewood; collecting at Beckermonds, Ilkley and Ulleskelf was to be twice yearly. The first secretary of the Committee was C. A. Cheetham. In 1926, the names of J. R. Dibb and W. C. Hincks appear in the excursion reports in *The Naturalist*, and in 1929 came the first Fresh Water Biology Report, edited by J. M. Brown. This was followed by the First Ephemeroptera Report in 1932 and the names of several entomologists working on the order were acknowledged. In 1945 J. R. Dibb's paper *Yorkshire Mayflies or Ephemeroptera* was published as part of the *Transactions* of the YNU. This list of 37 species recorded in Yorkshire covered all the vice-counties, although it is far from comprehensive in terms of distribution. It also included a bibliography and remains the basis for all later work. In 1945 H. Whitehead published additional records for 18 species and in 1946 J. R. Dibb published a short Addenda and Corrigenda to his 1945 paper.

Between 1927 and 1947 was the period of the greatest activity and research in this field by members of the Union. The report produced jointly by Percival and Whitehead on the ecology of rivers belong to this period. In the following decades interest in fresh water biology declined and there were few active workers interested in the mayflies. During the 50 years which have elapsed, records of mayflies published in *The Naturalist* are sparse and the information of the YNU entomological record cards for the Ephemeroptera is indeed meagre. However, since the relaunching of the Fresh Water Biological Section of the YNU in 1989, many new records from all the vice-counties have been added and the distribution and life cycles of the less common upland species, e.g. *Amelitus inopinatus* and *Siphlonurus lacustris*, are becoming better known.

My own interest in the mayflies goes back more than 60 years. I had an interest in fishing from an early age and was aware of the importance of the mayflies from *The Compleat Angler*. In 1928, I visited Bolton Abbey for the first time with a school party and persuaded an angler to show me the contents of his fly-wallet. I clearly remember the fine imitations of the Greendrake. After many years living in the north-east and other parts of the county I came to live quite close to the river at Pool-in-Wharfedale. Eric Thompson, who is still active in the Union and who had been a pupil of Whitehead, reminded me that much of the investigation work which had formed the basis of Percival and Whitehead's report had been done on the Wharfe at Pool and Harewood. He suggested that I might wish to re-investigate the river fauna after an interval of 40 years because very little had been done in the meantime; moreover the Executive of the YNC had already approved the re-activation of the defunct Fresh Water Biological Section and the time might be opportune to attempt to do so. A further 23 years were to pass before the Section was reformed. Eric Thompson possessed several of Whitehead's published papers and kindly gave them to me. There have been very few entomologists in the YNU studying the Yorkshire mayflies during that period.

However, the predecessor of the Yorkshire Water Authority (YWA), the Ouse River Board, had partly financed the work of Percival and Whitehead and more extensive work had been done since 1956 by them and later by their successors the YWA. In 1967 the YWA began monitoring the invertebrates at 60 sites throughout the area of the county which they controlled, and by 1976 had carried out surveys at more than 1,000 sites. The sampling of invertebrates was encouraged by the Department of the Environment due to the growing awareness of the need for a biological classification of rivers as well as a chemical one.

The Water Quality of Rivers

The demand for pure water for potable and industrial use had increased rapidly after 1945 and the supplies of the impounded water from the upland reservoirs became inadequate, as was shown dramatically in 1959 when supplies in the Washburn Valley reservoirs failed and they virtually dried up. Additional supplies were sought and although some new reservoirs were built it was clear that new supplies would have to come (at least in the short term) from boreholes and river abstraction. The consequences of this have had profound effects on the flora and fauna and have created problems which are still far from being resolved. Rivers are more prone to pollution than reservoirs since pollution can be spread downstream. Chemical analysis is one method of assessing pollution but it was already well known that invertebrate sampling on a regular basis could be used to assess water quality and to determine short and long term changes in quality. The development of systems of classification of river quality by invertebrate sampling was encouraged by the authorities and a number of systems came into use. All are based on the presence or relative abundance of families of aquatic invertebrates, which are affected by differing degrees of organic pollution. The presence of these groups can be linked to a standard test of a water sample, the Biochemical (Biological) Oxygen Demand (BOD).

Among the systems which have evolved are: Trent Biotic Index (Woodiwiss); Biotic Score (Chandler 1970); Biological Monitoring Working Part Score (BMWP). The latter is the one most widely used at the present time. The method is not complicated and in most cases it is not necessary to determine the invertebrates collected down to species.

A score on a scale of 10 down to 1 is allotted to groups of invertebrates collected in a sample; mayflies, caddis flies and stoneflies mostly score 10; in the lowest groups are: some molluscs = 3, Chironmids = 2, all *Oligochaeta* = 1. The total score is added to produce an average score per taxa which can be directly related to a classification scale. A computer programme RIVPACS is also under development but at the present time it is not in general use.

Since mayflies at some time of the year may account for as much as 20% of the biomass, they are an important integer in any invertebrate classification system.

In the case of the Ephemeroptera the surveys are carried out entirely upon the nymphs and although if they are well developed most can be identified fairly easily down to species, there are problems in doing so in some families, e.g. *Baetidae*, particularly when they are very small. It is for this reason that one of the most abundant species on the Wharfe, The Pale Watery, *Baetis fuscatus* is not separated in the YWA lists. It is necessary to explain that the eggs hatch as larvae and are termed nymphs as they develop; they resemble fairly closely the adult and after a series of moults (instars) emerge to become the winged sub-imago (the angler's Dun). The final metamorphosis is the imago (the angler's Spinner). However, the distribution records of the YWA collated between 1971 and 1976 are probably the largest group of records of Yorkshire mayflies available at the present time and voucher specimens identified by various authorities have been retained. Work has slowed down during the past decade although some of the work is not done by the National Rivers Authority (NRA). The other large group of records is that of the author who has identified and recorded adult insects as well as nymphs. The collection of nymphs throughout the year is simple; it can be done at specific locations and at different seasons. The observation of adults is more difficult for the following reasons:

1. Some species have a two year life cycle.
2. Some species are univoltine while others are bivoltine and this may vary in different years.
3. The emergence of the whole population of some species may occur in a very short period of time, so that records depend on the presence of the observer.
4. The period of emergence of the adults may take place over several weeks or even months and the numbers hatching may at times be quite small, e.g. *Baetis* spp.
5. Some species emerge at dusk or at dawn and the metamorphosis from sub-imago to imago is quite rapid, e.g. *Caenis* spp.
6. The adults are often difficult to locate in their shelter in high trees or even on bridges and buildings.
7. The populations of certain species are small and the duns emerge individually, e.g. *Heptagenia sulphurea.*
8. The less common species, which in Yorkshire are mainly confined to the uplands, appear to emerge over a very short period of time in good weather when the wind speed is low.

It is clear that a naturalist studying the Ephemeroptera and living close to a large river system has considerable advantages over the casual observer. The method of sampling invertebrates is by disturbing the bed by a set number of standard 'kicks' and collecting the invertebrates in a net; after sorting, this produces a reasonably reliable indication of the biological quality of a river; it is less so for lakes, reservoirs and deep tidal stretches where there are physical limitations in sampling. In rivers, the statistical variations can be complex; surveying may be hindered by the topography and the season of sampling (although it is mainly confined to Spring, Summer and Autumn). The aquatic and marginal vegetation was not taken into account in the earlier surveys and the biological effects of augmentation, abstraction and inter-river transfers has only begun to be investigated in recent years.

The Distribution of Ephemeroptera in Yorkshire

The maps showing the water quality of Yorkshire rivers equate closely to the distribution maps of the riverine species of the *Ephemeroptera* in the county. Apart from some genera of the *Caenidae* and the *Baetidae*, the abundance of mayflies, stoneflies and most caddisflies declines as the water quality deteriorates from Class 1 to Class 2. The higher levels of the rivers and their tributaries are swift flowing and mainly stony-bottomed and the invertebrate and vertebrate fauna are highly specialised. Mayflies also have a distinct preference for streams which have a pH value >7 although this may be directly related to the algae and microflora on which they feed. None of the British species are predators.

The most ubiquitous species are the *Baetidae*; one species, *Baetis rhodani*, called by

anglers the Large Dark Olive, is found in every Yorkshire river system and is widespread throughout the British Isles. It may be seen on the wing in small numbers during every month of the year and occurs in such varied habitats as the calcareous rills which drain into Malham Tarn to the deep slow-flowing waters of the Ouse. The stated periods during which the *Ephemeroptera* may be seen on the wing can be misleading; for instance, the peak hatch of *B. rhodani* in Yorkshire is during May and it appears to be univoltine in most years, being bivoltine in years when there is a prolonged drought and high water temperature.

Pond and Lake Species

Many of the upland reservoirs in Yorkshire have been created in steep-side narrow valleys and do not have large populations of mayflies; there are few natural lakes in Yorkshire but small ponds and disused gravel pits with macrophytes are likely habitats provided that they are not polluted. There are no British species which are only found in lakes and ponds, but certain species which are adapted to slow flowing rivers may be found in stillwater and reservoirs, particularly those which are formed by damming streams. The large mayfly *Ephemera danica* is widely distributed throughout Yorkshire on calcareous rivers but as the nymphs are silt burrowers they tend to be absent from fast flowing, stony-bottomed rivers unless the habitat has been modified. Occasionally this occurs naturally when a stream becomes blocked and silt accumulates, but more often when a dam has been built across the river, allowing deep silt to build up along the banks. This is typical of the R. Nidd which has a large greendrake population upstream of the weirs. If the weirs are destroyed, the insects usually disappear from that reach of the river, as is known to have happened at Arthington on the R. Wharfe. On the little R. Dove in Douthwaite Dale in North Yorkshire there is a large population of *E. danica* in deep silt washed down from the moors but this stream is calcareous and has a high pH value.

A close relative, *E. vulgata*, the anglers' Dark Mackerel, occurs in huge numbers in Swinsty Reservoir, in some adjacent reservoirs and in the Leeds/Liverpool Canal from Gargrave to the centre of Leeds. In the eastern side of the county it was once recorded from the Sea Cut at Scalby where its current status is not known. Its distribution is very local in England, occurring mainly in slow flowing rivers and meres in the west, but is spreading to man-made lakes and disused gravel pits in the Midlands and the south.

E. vulgata was first recorded on the Leeds/Liverpool Canal at Gargrave in 1927 and in 1931 at Winterburn Reservoir which is a supply reservoir for the Canal. It is remarkable that its spread via the Canal was unnoticed by the entomologists, although swarms were pointed out to me at Esholt by a Bradford naturalist in 1952 under the name of *E. danica.* The sub-imagos frequently rest on barges during cool weather and travel many kilometres in this way. My investigations of its occurrence in Cheshire and Lancashire when I lived there would indicate that the canal is the obvious route by which the species came into Yorkshire.

Two species of the *Baetidae, Cloeon simile* and *Cloeon dipterum*, the Pond and the Lake Oliver, have been recorded from Malham Tarn. On the record cards at Malham and in the YNU Malham Reports only *Cloeon simile* is recorded, but during the two-day YNU excursion to Malham in May 1993, only nymphs and adults of *Cloeon dipterum* were found. Extensive surveys of the Tarn were made from a boat during the excursion and a light trap was operated. Further surveys have not produced any specimens of *C. simile; C. simile* nymphs are usually found at a depth of *c.* 2 metres and have a preference as a habitat for the Water Milfoil *Myriophyllum spicatum*, which does occur in the Tarn. It is interesting too that *C. dipterum* is the only European mayfly which is ovi-viviparous; the female rests 10 to 12 days before returning to the water to oviposition, when the eggs hatch immediately on contact with the water. I have only once located resting, fertilised females.

25 Years of Studying The Yorkshire Mayflies

The author's approach was first to attempt to determine what changes, if any, in the

distribution and abundance of mayflies had taken place in the intervening years since Percival and Whitehead published their 1930 report. Fortunately, the exact dates of the surveys are given in the reports, making comparisons fairly reliable. The list of mayfly species recorded at Pool was unchanged but pollution from industry, agriculture and sewage was on a scale much greater than that noted at Pool Bridge between 1928/1930. The comparison of the abundance of the populations was more difficult but it was possible to make biological classification comparisons for some stations. In 1968 the river declined to class 2 downstream of Pool Bridge and mayflies declined in numbers towards the tidal reaches. Feeding Dippers are a good indicator of the presence of mayflies; they are not often seen downstream of Arthington Viaduct. In subsequent years, in spite of the improvements in sewage treatment, the quality did not improve dramatically and the industrial pollution was a source of concern. The maps showing the water quality of Yorkshire rivers between 1968 and 1994 equate clösely to the distribution of mayflies.

The Macrophytes

The most noticeable change over the next 15 years was in the reduction in the river vegetation of the Wharfe. Limited information on the distribution of the macrophytes of Yorkshire rivers over the past 120 years may be obtained from the *Transactions* of the YNU and the *Floras* of F. A. Lees, W. G. Baker and J. F. Robinson. A more recent survey of the Wharfe was that of R. W. Butcher in 1933; this indicated for example, that the Water crowfoot *Ranunculus fluitans* was dominant in the swift portions and frequent in the slower portions. This plant does not occur on the Wharfe today and may be extinct in Yorkshire.

The Water Crowfoot *R. penicillatus* subsp. *pseudofluitans*, which had been a feature of the river, had decreased since the 1930s and had become virtually extinct upstream of Pool. The presence of macrophytes plays an important role in the abundance of invertebrates in any river system, resulting in some authors giving a pollution tolerance relating to groups of British macrophytes. Replanting of *R. penicillatus* subsp. *pseudofluitans* has been taking place systematically in the Wharfe from Grassington down to Harewood Bridge since 1990 and the plant is becoming re-established in well oxygenated parts of the river. The reappearance in huge numbers of a caddis fly *Brachycentrus subnubilus* on the mid-Wharfe is believed to be in part due to the increase of some macrophytes in recent years. Although the increase in macrophytes in some rivers is due to eutrophication, the presence of the mayflies in some numbers (except *Baetis rhodani*) does usually indicate good quality.

Current Research on the Ephemetoptera

The Fresh Water Biological Association published its first key to the *Ephemeroptera* by D. E. Kimmins in 1942, followed by a separate key to the larvae in 1961. Since the first publication there has been a growing interest in the order in Europe and in America, which has resulted in a large number of published references. There have also been several International Ephemeroptera Conferences. There are few aspects of the life cycle which have not now been studied. We now know that of the 48 British species, 30 occur mainly in running water and 18 in both running and standing waters.

In spite of the intensive work on individual species both in the field and in the laboratory, there are some aspects of the life cycles or behaviour which have not been resolved and the author has kept observations on a number of species which are common or locally common and over whose habits there is a question mark.

Oviposition

The method of oviposition varies: some Yorkshire species enter the water to deposit their eggs on stones, e.g. *Baetis rhodani*. Although this is well documented I have not found it easy to observe on large rivers, and the females do dip the abdomen while flying upstream. It has been suggested that the purpose is to moisten the eggs. (There is a parallel with a British caddis fly *Brachycentrus subnubilus* which dips but ovipositions under water.)

Baetis fuscatus hatches in huge numbers on the Wharfe and the Ure with a peak between the end of May and mid-June. It is estimated that 90% of the nymphs emerge during this period. The triggering factor appears to be a combination of light intensity, high barometric pressure, low water flow and light wind speed.

During the period of emergence, birds, fish and bats feed intensively upon both the nymphs and the winged adults. After swarming and mating the females fly upstream and oviposition by dipping in the surface film, usually in water 0.5 to 1 metre deep, but avoid 'broken water'. Although I have never seen winged adults of this species entering the water, other observers claim to have done so. It is possible that experiments with artificial streams may give rise to variations in behaviour.

Ephemera vulgata

In Yorkshire and elsewhere the eggs are deposited on warm days when there is very little wind. The usual time is during the afternoon but when the weather has been windy during the preceding days, followed by a calm day, very large numbers of females will leave the surrounding trees from as early as 7 a.m. and ovipositioning may continue throughout the day until evening. On such days swarms of males may be seen flying close to a marker; dam walls, buildings and dead trees are typical sites and are always close to the area where ovipositioning will take place. The same sites have been noted for over a period of 20 years.

The areas selected for ovipositioning are the same areas where the nymphs have passed the previous two years in their burrows. These areas follow the course of streams which were submerged when the reservoirs were built and through which currents of water flow from the connecting feeders. At normal water levels it is not possible to capture nymphs but in drought years it is possible to examine the sites and to count the number of burrows per square metre.

Downstream Drift and Migration

There is a downstream drift and some upstream movement of nymphs in rivers and streams. Some of this voluntary but very large numbers of invertebrates are washed out during periods of heavy flooding, particularly on the spate rivers; macrophytes are torn out and may be deposited to regenerate successfully downstream; in some severe floods more than 50% of the beds of aquatic mosses such as those found on the extended base of Harewood Bridge may be completely washed away and even be deposited in adjoining fields. The larvae and the over-wintering eggs of one of the most abundant species of mayfly *Ephemerella ignita* (the anglers' Blue-winged Olive) occur in millions in some of the beds of aquatic mosses, particularly *Eurhynchium rusciforme*. Those species whose eggs overwinter or whose larvae do not develop during the winter would therefore appear to be most vulnerable to loss of habitat. The adult mayflies whose nymphs are burrowers *(Ephemera)* do not travel very far from the point of emergence. The adults of the *Baetidae* and *Ephemerellidae* certainly do fly long distances (up to 1 km has been observed). In Yorkshire, this movement is mainly upstream, but downstream movement 'in huge numbers' in search of 'broken water' (indicating submerged vegetation) was described by the well known Test river keeper, A. J. Lunn. At Castley on the Wharfe and elsewhere, *E. ignita* has been known to leave the river and follow nearby roads for more than 1 km and oviposition on the damp road surface and upon parked motor vehicles. This behaviour has been noted towards dusk after rain, when the river is running high; no doubt the road surface with pools is mistaken for 'broken water' as observed by L. Magee over the period 1970-1990. Published references do suggest that upstream migration is minimal; the author's observation is that this is true for the species which are least vulnerable to disturbance, e.g. species with burrowing nymphs and those with stone-clinging nymphs.

Colonisation

Mayflies do colonise lakes but little has been published. They are known to have been

introduced successfully by anglers into man-made lakes such as fish ponds and gravel pits, and have also colonised lakes and ponds close to rivers and canals (*Cleon dipterum* can be found even in water butts). In 1991 *Ephemera vulgata* was seen emerging in a moorland pond which had been formed in 1989 by damming a small stream. This pond was 8 km from the nearest known colony and the owner was adamant that no insects or animals had been deliberately introduced. Eaton (1883-88) quotes examples of swarms seen at a height of 500 feet above the Rhine but most descriptions of mating flights in literature indicate a height of between 2 and 10m. Swarms of *Baetis rhodani* have been observed at a height of 15m, above tall trees adjacent to several Yorkshire rivers.

Conclusions

There have been few additions to the list of Yorkshire mayflies published by J. R. Dibb in the *Transactions* of the YNU in 1945 and it seems unlikely that many more will be added. Additional species found in Yorkshire in recent years are *Heptagenia fuscogrisea* and *Caenis luctuosa (moesta)*. There are however a number of species for which there are few Yorkshire records but which may prove to be more widespread since they occur in neighbouring vice-counties.

A Check List of Yorkshire Mayflies

	Anglers' Name	Status
1. *Siphlonurus armatus*	Summer Mayfly	Local, VC64. No recent records.
2. *Siphlonurus lacustris*	Summer Mayfly	Local, VC62, VC63, VC64, VC65 (Upland species).
3. *Ameletus inopinatus*		Local, VC62, VC64, VC65.
4. *Baetis rhodani*	Dark Olive	Widespread in Yorkshire in rivers.
5. *Baetis atrebatinus*	Dark Dun	Rare. R. Swale.
6. *Baetis fuscatus*	Pale Watery	Abundant on some rivers in all vice-counties.
7. *Baetis scambus*	Small Olive	Widespread in rivers in all vice-counties.
8. *Baetis vernus*	Medium Olive	In all vice-counties but less common than *B. scambus*.
9. *Baetis muticus*	Iron Blue	Widespread in rivers in all vice-counties.
10. *Centroptilum luteolum*	Little Sky Blue	In all vice-counties but not on all main river systems.
11. *Centroptilum pennulatum*	Blue-winged Pale Watery	Local, VC62, VC63, VC64, VC65.
12. *Cloeon dipterum*	Pond or Lake Olive	In unpolluted ponds and lakes with aquatic vegetation.
13. *Cloeon simile*	Pond or Lake Olive	Local, VC64, VC65.
14. *Procloeum bifidum*	Little Pale Blue	VC62, VC62, VC63, VC64, VC65.
15. *Rhithrogena semicolorata*	Yellow Upright	Widespread in stony bottomed streams.
16. *Heptagenia sulphurea*	Primrose Dun	Local, main rivers in VC64, VC65.

17. *Heptagenia fuscogrisea*	Brown May Dun	Only in R. Derwent, Driffield Beck and R. Hull.
18. *Heptagenia lateralis*	Dark Dun	In lakes and rivers, local, VC62, VC64, VC65.
19. *Ecdyonurus torrentis*	Brook Dun	In all vice-counties. Prefers stony bottomed streams.
20. *Ecdyonurus venosus*	March brown	Widespread in unpolluted stony bottomed streams.
21. *Ecdyonurus dispar*	August Dun	In all vice-counties. Prefers stony bottomed streams.
22. *Ecdyonurus insignis*	Large Green Dun	Local, R. Ribble, R. Wenning and R. Swale.
23. *Leptophlebia marginata*	Sepia Dun	Local, VC63, VC64 lakes and streams.
24. *Leptophlebia vespertina*	Claret Dun	Local, lakes and slow streams.
25. *Habbrophlebia fusca*	Ditch Dun	Slow streams with vegetation, VC61, VC62, VC64, VC65.
26. *Paraleptophlebia submarginata*	Turkey Brown	Small stony streams, VC62, VC64, VC65.
27. *Paraleptophlebia cincta*	Purple Dun	Small stony rivers, VC62, VC64, VC65.
28. *Ephemera vulgata*	Dark Mackerel	Morehall Reservoir VC63, Leeds/Liverpool Canal VC63 and VC64; reservoirs in VC64.
29. *Ephemera danica*	Greendrake	All vice-counties; lakes and rivers, chiefly slow-flowing.
30. *Ephemerella ignita*	Blue-Winged Olive	In fast flowing rivers in all vice-counties.
31. *Ephemerella notata*	Yellow Evening Dun	Similar habitat to last species but much more local, VC64, VC65.
32. *Brachycercus harrisella*		Local on Ouse tributaries: Wharfe, Swale, Ure, Nidd and Pocklington Canal. Maybe under-recorded.
33. *Caenis macrura*	Anglers' Curse	Very local. Aire, Wharfe and Ure.
34. *Caenis luctuosa*	Anglers' Curse	Local, VC62, VC63, VC64.
35. *Caenis horaria*	Anglers' Curse	Local, VC63, VC64.
36. *Caenis rivulorum*	Anglers' Curse	Stony streams. Local, VC64, VC65.

NOTE.
Very large areas of Yorkshire are underworked and some old records are dubious. The checklist is therefore merely a guide to the verified Yorkshire species. Distribution maps for all species are in preparation.

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BOOK REVIEWS

The Badger Man: memoirs of a biologist by **Ernest Neal**. Pp. x + 274. with 22 black and white photographs and 6 cartoons. 1994. Providence Press, Ely, Cambridgeshire. £13.95 paperback.

Ernest Neal is well known as the leading authority on the biology of our native badger. His reputation has been established through many years of study, publication of books and scientific papers, service on committees and advisory bodies and appearances on radio and television. This is the public image but only when reading his autobiography does one appreciate the much greater diversity of his contributions in what has been a rewarding life.

The son of a Baptist minister, Ernest (born in 1911) was the youngest of four children. While the family lived modestly, Ernest nevertheless experienced a diverse and rewarding childhood, being introduced to natural history through his father's interest in butterflies. Completion of a degree course at London University, while posing few academic

difficulties, did throw up a number of financial problems which were only resolved by taking up junior teaching positions, undertaking odd jobs and attending evening classes at Chelsea Polytechnic. Throughout his memoir comes through a burning enthusiasm for natural history, not only of butterflies but equally of all plants and animals whether terrestrial or marine. His badger interests were, in fact, not initiated until he was established in his first teaching post at Rendcombe College.

Ernest Neal's prime professional commitment was to school teaching, first at Rendcombe and then at Taunton, where he served as Head of Science, Housemaster and Deputy Head. His dedication, wisdom and sincere interest in his boys constantly emerges. Even with these considerable responsibilities his commitment to natural history could not be submerged. More than that, he has undertaken fundamental research on the biology of the badger, particularly its reproduction, social behaviour and status which has been the foundation for much further study. How stimulating it must have been for his students to have had such a teacher. Photography and the media were among his other interests and it is through his anecdotes and vignettes of various episodes that the events of the past, many in the early days of natural history broadcasting, come to life.

That Ernest Neal has lived a full and rewarding life bursts forth from this book. Teacher, author, scientist, administrator, photographer and broadcaster are among his many roles, while his geographical experience extends from Britain to much of Africa and Europe. His family connections, which feature prominently, have been deep and strong, initially through his parents and siblings and subsequently and for over fifty years through his wife Betty and their children. Equally strong is his religious commitment. He writes well, conveying his own enthusiasm, but is never assertive as to his own successes and contributions. The book is more than a good read, it is an example of considerable achievement (from time to time against a background of serious ill health) for which we are all the richer.

MJD

Flora Europaea. Volume 1: Psilotaceae to Platanaceae. Edited by **T. G. Tutin *et al.*** 2nd edition. Pp. xlvi + 581, including 5 maps. Cambridge University Press. 1993. £100.00.

The first volume of this prestigious work, hailed on its first publication 30 years ago as a model of its kind for international use, has now been thoroughly revised and considerably extended to include a larger number of taxa, each of which is described with admirable clarity and conciseness. The original highly satisfactory format and style have been retained. It will be noted that its subtitle has necessarily been changed to accommodate the interesting discovery in south-west Spain of a 'tropical and subtropical' psilophyte, *Psilotum nudum*.

All the useful features of the first edition are included, but the use of contrastingly coloured pages for easy cross-referencing of the Explanatory Notes and the Glossary of Technical Terms has been dropped, which is a pity: presumably the publishers felt that this was an unjustifiable luxury in an already unavoidably expensive volume.

Flora Europaea is sponsored by the Linnean Society of London and the preparation of this new edition of Volume 1 has been supervised by an editorial committee based in Britain and Ireland which has coordinated a mass of data from international sources, much of it via an impressive body of experts; the appendices, for example, provide biographical and bibliographical information on more than 1300 botanists and their publications.

Both editors and publishers are to be heartily congratulated on realising this monumental project, which will be enthusiastically welcomed throughout the botanical world. Sadly, however, it seems that at present some doubt hangs over the production of a revision of the remaining four volumes of this indispensable work.

MRDS

OTTERS (*LUTRA LUTRA* L.) AS SCAVENGERS: AN EXPERIMENT

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Introduction

Salmon *Salmo salar*, spawning in the upper reaches of the River Dee and its tributaries in north-east Scotland in November and December, provide a potentially large supply of food for otters, either as prey or carrion. Otters readily take salmon in the shallow water at the spawning redds (Carss *et al.* 1990), in addition to which many salmon carcases are available to scavengers from fish that die after spawning. Only 3-6% of salmon that have spawned return to spawn a second time (Mills 1986). Thus salmon carrion provides an abundant seasonal food supply along the Dee, amounting to as much as 36 kg. km^{-1} along the river bank (Hewson 1995). This paper describes scavenging by otters based on an experiment in which radio-tagged salmon carcases were provided to determine the extent to which otters scavenge when live fish are readily available.

Study Areas

The study areas comprised 900 m of the Burn of Cattie from its junction with the river Dee, and 400m of the Beltie Burn, which joins the Dee 4.0 km downstream and 6.5 km downstream of the confluence of Dee and Cattie (Figure 1). Both are used by spawning salmon which travel several km further upstream to spawning redds.

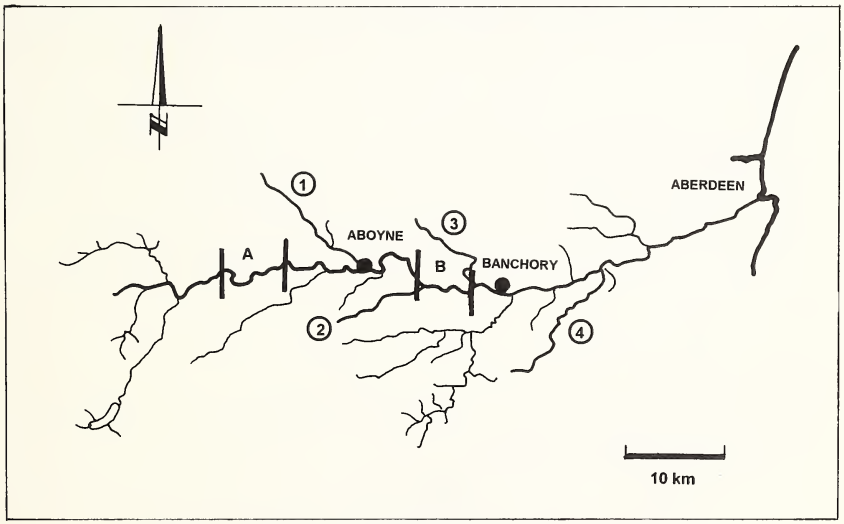

FIGURE 1
Study areas on River Dee; **A** Dinnet, **B** Blackhall. Streams used by spawning salmon; (1) Tarland, (2) Cattie, (3) Beltie, (4) Sheeoch.

The Cattie is 4-5m wide, and 0.3 –1.0m deep, with riffles and pools, the bottom sandy or gravel-covered. Alder *Alnus glutinosa* and birch *Betula* spp. line the banks and fallen branches obstruct the flow of the stream and cause salmon carcases to lodge in them.

The 400m of the Beltie burn is 3-4m wide, slow-moving and silt-bottomed. It is therefore unsuitable for spawning salmon which pass through to spawn in the upper reaches. The banks were steep and man-made during former drainage operations, and were

partially lined with willows *Salix* spp. Otters were common and fed largely upon brown trout *Salmo trutta* outside the spawning season of salmon when there was little other aquatic prey (Kruuk *et al.* 1993).

Other scavengers, which occurred on both study areas and might have benefited from salmon carcases landed by otters included mink *Mustela vison*, fox *Vulpes vulpes* and various scavenging birds, heron *Ardea cinerea*, carrion crow *Corvus corone*, and moorhen *Gallinula chloropus*. Great black-backed gulls *Larus marinus*, which regularly scavenge salmon carcases along the Dee, did not forage along the tributary burns.

Methods

Twenty-three female salmon carcases, intact except for the stomach and part of the snout, were fitted with radio transmitters (Hewson 1995). Between 24 November 1992 and 10 March 1993, 14 of these were placed, two at a time, in shallow backwaters in the Cattie and two in the Dee nearby. They were replaced when scavenged or washed away by spates.

Seven carcases were placed singly, and replaced when gone, on a small sandy spit at the water's edge on the Beltie which regularly showed tracks of otters, and where otters had scavenged carcases in an earlier study (Hewson 1995). The spit was too small to accommodate two salmon and the adjacent stream narrow and shallow.

Radio-tracking was carried at intervals of 1-3 days on the Cattie and 1-12 days on the Beltie.

The remains of salmon killed or scavenged by otters were generally found within 2m of the water with a trail through the vegetation from the water's edge and in some cases otter tracks in sand or mud. There was no attempt to conceal the carcase and otters did not seek secluded places to feed. Otters fed between the head and dorsal or belly fins of salmon carcases, sometimes biting through the spine or removing the carcase except for the head. Freshly killed fish showed blood and scattered scales.

Of the other scavengers of salmon carcases, crow and great black-backed gulls were seen feeding at some of the experimental carcases. Crows have difficulty in breaking into salmon carcases and generally do so at the anus or by making small pits 1-2cm in diameter and 1cm deep in rotting carcases. They remove the eyes from fresh carcases of various species often without further scavenging (Houston 1978, Hewson 1984, 1995). Great black-backed gulls tore large pieces from salmon carcases but left no diagnostic signs.

Mink fed where an otter had already broken into a salmon carcase, sometimes extending the area by feeding to a depth of *c.* 1cm below the skin, and also at the head between eye socket and snout.

Results

Scavenging by otters

Of the 16 radio-tagged carcases put into the Cattie and Dee six were washed away by spates (see below). Otters hauled out the remaining 10 and scavenged nine of them (Table 1). The tenth was scavenged by birds.

TABLE 1

Scavenging of salmon carcases placed in water (Cattie burn) or at water's edge (Beltie burn)

	Number of carcases				
	Put in	Removed by spates	Hauled out	Otter scavenged	Fate unknown or other scavenger
Cattie/Dee	16	6	10	9	1
Beltie	7	0	7	4	2

All the carcases were found within 2m of the water or in the stream or river. Within a three-week period three carcases had been taken 20-30m upstream where they were scavenged on boulders and at the water's edge. One of the two carcases in the Dee was scavenged at the water's edge, the other on a groyne 2m upstream of where it had been put in. Both were fully scavenged.

All seven carcases put out at the Beltie were moved by otters, which left tracks in the sand; they scavenged at least four of them (Table 1). They did not take carcases from the water to the nearest place on the bank as at Cattie presumably because the banks of the Beltie burn were steep and one bank was alongside a public road. Instead, salmon carcases were either taken to the mouth of a culvert beneath the road, 110m upstream from the spit where they had been placed, or to the far bank 95m downstream. Radios from two of the remaining three carcases were traced to the middle of an arable field 800m from the Beltie and a conifer plantation 1.0 km away respectively. They may have been taken there by foxes after otters had recovered them from the shallow water and silt which had covered them since they were put out. Foxes are known to remove salmon carcases from the bank before feeding on them (Cuthbert 1973, Hewson 1994).

Carcases moved by spates (Table 2) were washed into deeper water or lodged beneath driftwood. They were not scavenged by otters. Four of the six were moved out of the study area. One of these was found, thought to be scavenged by great black-backed gulls, 6 km downstream of the study area.

TABLE 2

Salmon carcases placed in Cattie burn and removed by spates

Date put in	Date of spate	Observations
13 Dec.	19 Dec.	Found 5 Feb., not scavenged
13 Dec.	19 Dec.	not found in study area
19 Dec.	26 Dec.	lodged beneath driftwood
27 Dec.	5 Jan.	6 km downstream bird scavenged
27 Dec.	15 Jan.	in R. Dee, 11 Feb.
10 Jan.	15 Jan.	not found

TABLE 3

Salmon carcases moved by otters from Burn of Cattie

Time (days)	Initial weight (kg)	Amount scavenged by otters (kg)*	
2	2.04	1.36	fully scavenged
1	2.81	0.57	
10	2.67	2.10	fully scavenged
8	2.16	1.16	
3	1.96	>1.50	fully scavenged
12	3.07	1.53	
2	2.07	1.59	fully scavenged

* when found. Some carcases were further scavenged by otters later .

Otters fed substantially upon salmon carcases placed in the Cattie, some of which were hauled out and scavenged within three days (Table 3). Carss *et al* (1990) found that otters killing spawning salmon on the Burn of Sheeoch, another tributary of the Dee, took an average 975g as a single meal. These were larger fish than those used in the present study and feeding occurred chiefly behind the pectoral fins. On the smaller carcases used in this study scavenging occurred in the same area but extended further towards the tail; in fully scavenged carcases only the skull, vertebrae, tail and skin, weighing together about 0.6 kg, remained.

Amounts scavenged by otters at Cattie (mean 1.40kg, range 0.57-2.10) were larger than at Sheeoch but fell within the same range, 0.29-2.08kg. At Sheeoch otters obtained most of their daily food requirements by catching one salmon from those readily available on the spawning redds. There was no spawning redd within the Cattie and Beltie study areas and with food less readily available otters ate more from each carcase and returned to some of them for further scavenging. If fully scavenged carcases at Beltie (Table 4) were assumed to weigh 0.6kg the average amount eaten by otters there, 1.35kg, was similar to Cattie.

TABLE 4
Salmon carcases moved by otters at Beltie

Time (days)	Initial weight (kg)	Amount scavenged by otters (kg)*
7	2.53	fully scavenged later
10-18	1.08	scavenged by fox later
3	2.44	fully scavenged later
2	1.84	0.97
1	2.70	0.64
1	1.73	scavenged by fox later
12-17	2.12	not found

* when found: some carcases were scavenged by otters later.

Live prey of otters along the Cattie

Between 29 Nov. 92 and 5 Feb. 93 the remains of nine salmon were found along the Cattie. One, a small female on a gravel spit, was scavenged by a heron which was flushed from the carcase. The remaining eight had been put on the bank by otters (Table 5). Seven had been killed (fresh blood). The eighth was a salmon seen dead in the water two days earlier. From these salmon a full meal (*c.* 1.4kg) or more had been taken; only the head remained of two fish. A similar amount (1.3kg) was scavenged subsequently, principally by otters.

The remains of the heaviest fish killed by an otter, from which a meal had been taken, weighed 4.9kg, indicating a live weight of around 6 kg, near the upper limit for salmon brought ashore by otters. (The average weight of a female otter is 7kg (Chanin (1991)).

Other scavengers of salmon carcases

Otters help other scavenging mammals and birds by removing salmon to the bank and leaving them partly eaten. Six of the seven salmon killed (and one scavenged) by otters along the Cattie provided food for other scavengers (Table 5). Crows were involved in all cases, removing eyes or making small pits in flesh. A great black-backed gull scavenged a carcase on which mink and crows had already fed, but mink scavenged only one carcase and great black-backed gulls two.

The experimental carcases hauled out by otters on Cattie also provided food for other scavengers. Mink scavenged three, taking between 71g and 284g per day, when more than one mink may have been involved. Crows removed eyes from four carcases and, during a period of snow-lie, fed upon one which had lain on the stream bank for 83 days. Tracks and droppings indicated that crows had fed along with mink at three carcases.

Scavenging of salmon carcases at the Beltie by foxes has already been discussed. On the Sheeoch, Cuthbert (1973) found substantial scavenging of dead salmon by badgers *Meles meles* and foxes, both of which removed carcases from the stream bank.

The amounts taken by scavengers other than otters were usually small and there was no evidence of competition for salmon carrion between otters and other bird or mammal scavengers (Hewson 1995, this study).

TABLE 5

Feeding on salmon killed (and one scavenged) by otters along Cattie 29 Nov. 92 to 5 Feb. 93

Date	Killed or scavenged	Weight (kg) when found	Subsequent scavenger	Amount eaten later (kg)
29 Nov	scavenged	2.36	otter, crow	1.33
1 Dec	killed	4.90	mink, crow, gull	–
12 Dec	killed	3.80	crow	–
28 Dec	killed	2.58	otter, crow	1.28
9 Jan	killed	head only	crow	–
19 Jan	killed	1.28	otter, crow, gull?	0.89
19 Jan	killed	2.16	otter, crow	1.73
5 Feb	killed	head only	none	–

Gull refers to great black-backed gull.

Discussion

Salmon, as prey or carrion, are clearly important to otters during the spawning season (Hewson 1995). On a 7.5 km stretch of the Dee (B on Fig. 1) the salmon carcases found during December and early January could have provided the entire food supply of one or two otters taking only a single meal from each carcase. However, the salmon carcases on a 9 km stretch 21 km upstream (A), with a more rapid flow and few tributaries used by spawning salmon, would not have sustained an otter even if it had scavenged them fully (Hewson 1995).

This study shows that otters readily take salmon carrion even when live fish are available and easily taken after spawning. Otters returned to feed on salmon they had killed and fed upon earlier, and then ate amounts equivalent to the average otter's meal as described by Carss *et al* (1990). They also ate similar amounts of carrion from the carcases provided experimentally.

A tentative estimate of the food of otters on the Cattie during the study indicates that salmon carrion may have been their major food. Captive otters when hungry took dead fish in preference to live ones and slow-moving fish more readily than faster ones (Erlinge 1968). Wild otters presumably find salmon which have spawned (kelts), slow-moving in the backwaters which they frequent, an easy prey. Similarly, dead salmon lying in shallow water provide an easy source of food. Outside their spawning season large salmon are not a usual food of otters (Kruuk *et al.* 1993) although present in the Dee as fresh-run fish from February onwards, presumably because these are more difficult to catch than smaller prey.

In Ireland, O'Sullivan *et al* (1992) record sporadic otter scavenging of brown trout *Salmo trutta* L., sheep, cooked shrimps, *Crangon vulgaris* L. and domestic geese and fowls. Food remains on islands frequented by otters at Loch Park in north-east Scotland included brown hare *Lepus europeaus*, mallard *Anas platyrhynchos*, moorhen, woodpigeon *Columba palumbus* and pheasant *Phasianus colchicus*, all of which were probably scavenged rather than killed (Hewson 1973).

Scavenging of salmon carcases during the spawning season provides a substantial part of the otter's diet. At other times otters scavenge sporadically.

Acknowledgements
I am grateful to Anneke Stolte for help in the field, to Dr H. Kruuk for helpful discussions, to J. Morris, (I.T.E. Banchory) for technical assistance, and to landowners on whose ground I worked. The Vincent Wildlife Trust made a grant towards the cost of the work, and the Freshwater Fisheries Laboratory, Pitlochry, provided the salmon carcases. G. Woodroffe made helpful comments on earlier drafts.

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BOOK REVIEW

Flora of Radnorshire by **R. G. Woods.** Pp. xiii + 292, together with 9 pages of colour plates. National Museum of Wales, in association with the Bentham-Moxon Trust. 1993. £28.00 hardback.

This work maintains the traditionally high standards of county Floras and is a testimony to Ray Woods' detailed researches in mid-Wales over the past twenty years. Radnorshire is only one of several counties whose botany he has extensively explored, covering not only its vascular plants, but also its cryptogams; his ecological and conservation interests are also evident in this Flora.

Chapters are provided on the county's physical environment, plant communities (including a conspectus of their phytosociological classification), biogeography, changing flora, conservation and history of plant recording. The main body of the text provides ecological notes and locality details (maps on a tetrad basis given for the more widespread species) of flowering plants, ferns, mosses, liverworts and lichens; shorter sections deal with algae and cyanobacteria, and rust and smut fungi.

The volume is well produced, the text being admirably supported by maps, tables, line drawings and colour photographs of habitats. Thanks to the generosity of its several sponsors, the Flora is extremely reasonably priced.

MRDS

ACULEATE WASPS AND BEES (HYMENOPTERA: ACULEATA) OF BLAXTON COMMON IN WATSONIAN YORKSHIRE WITH THE INTRODUCTION OF A NEW NATIONAL QUALITY SCORING SYSTEM

MICHAEL E. ARCHER

Blaxton Common has been found to be an excellent locality for aculeate wasps and bees, having 123 recorded species, six species of national importance and ten species of regional significance. The Common, an area of about 150ha, is situated to the north-east of Blaxton, near Doncaster (VC63, SE6901). The region has sandy acid soils worked by the sand and gravel extraction industry. After sand extraction, dry open horizontal sand and small sandy clifflets are left. Vegetation has invaded the open spaces, leading to the development of birch and oak woodland. Sheltered by the woodland the open areas become important nesting and foraging resources for the aculeate wasps and bees. Continued growth of the birch and oak will eventually shade out the open areas but at present many open areas are present.

Between 1980 and 1993, 17 visits were made to a sample area, about 25ha, of Blaxton Common along either side of the road from Finningly to Wroot. These visits were distributed throughout the year as follows: April (2 visits), May (4), June (3), July (3), August (3), September (2). During these three-hour visits all species of aculeate wasps and bees seen were recorded (Archer sample) and usually collected with a hand net for identification. In addition, I have had access to a small number of records from H. H. Corbett (June 1918), E. W. Aubrook (June 1969) and P. Skidmore (April 1967), a larger number of records from J. D. Coldwell (August 1991) and J. T. Burn (1972-78), to whom I am most grateful. In the following account biological names are according to Kloet and Hincks (1978).

Results

Species present at Blaxton Common

At the family level, Table 1 shows the taxonomic distribution. The 122 recorded species represent about 46% of the aculeate wasps and bees recorded from Watsonian Yorkshire. In addition, J. T. Burn recorded the dryinid wasp *Anteon jurineanum* during May 1980.

The Archer sample of solitary wasps and bees consists of 315 records derived from 91 species (Table 2). Fifty-eight species (63.7%) were recorded on one, two or three days (unusual species) while the other 33 species (36.3%) were recorded on from four to 15 days (common species) (Table 3). Solitary bee species are more equally represented in the common (21 species) and unusual (27) groups compared with the wasp species which are represented more in the unusual (31) than the common (12) groups of species. Thus solitary wasps species would seem to be more difficult to find than solitary bee species. With 29 species (31.9%) only being found on one visit, the recording of further species is very likely.

A further eighteen solitary species have been recorded as follows: *Dipogon subintermedius* (=*D. nitidus*), *Anoplius nigerrimus*, *Ancistrocerus gazella*, *Tachysphex unicolor*, *Trypoxylon attenuatum*, *Crabro peltarius*, *Crossocerus cetratus*, *C. megacephalus*, *Ectemnius cavifrons*, *E. cephalotes*, *Stigmus solskyi*, *Pemphredon inornatus*, *Diodontus luperus*, *Nysson dimidiatus*, *N. spinosus*, *N. trimaculatus*, *Argogorytes mystaceus*, *Andrena cineraria*. Seventeen of these 18 species not found in the Archer sample are wasps species, indicating again the smaller probability of finding the wasp compared with the bee species.

The following ant, social wasp, and bee species have been recorded: Formicidae: *Myrmica ruginodes*, *Formica fusca*, *Lasius niger*; Vespidae: *Dolichovespula sylvestris*, *Vespula rufa*, *Paravespula germanica*, *P. vulgaris*: Apidae: *Bombus lucorum*, *B. terrestris*,

B. lapidarius, *B. pratorum*, *B. hortorum*, *B. pascuorum*, *Psithyrus bohemicus*, *P. vestalis*, *Apis mellifera*.

Seasonal progression of solitary species

From the Archer sample the solitary wasp species were only recorded during the summer months (Table 4). August was the most productive month for the number of species and individuals, and June, the month when the solitary wasp species first emerged, the best month for recording new species. The subterranean nesting species of the open sandy areas were very evident including the spider-hunting *Pompilus cinereus*, the caterpillar-hunting sand-wasp *Ammophila sabulosa*, the fly-hunting *Crossocerus quadrimaculatus*, the grasshopper-hunting *Tachysphex pompiliformis* and *Evagetes crassicornis* which is a cleptoparasite on other spider-hunting wasps.

TABLE 1

The number of species of aculeate wasps and bees recorded from Blaxton Common

	No. species
Solitary wasps	
Chrysididae	4
Mutillidae	1
Pompilidae	12
Eumenidae	3
Sphecidae	40
Total solitary wasps	60
Solitary bees	
Colletidae	6
Andrenidae	17
Halictidae	15
Megachilidae	3
Anthophoridae	8
Total solitary bees	49
Total solitary wasps & bees	109
Social wasps & bees	
Vespidae	4
Apidae	9
Total social wasps & bees	13

TABLE 2

The number of records and species of solitary wasps and bees recorded from Blaxton Common in the Archer sample

Family	No. species	No. records
Chrysididae	4	11
Mutillidae	1	4
Pompilidae	10	36
Eumenidae	2	2
Sphecidae	26	65
Collectidae	6	8
Andrenidae	16	94
Halictidae	15	62
Megachilidae	3	6
Anthophoridae	8	27

TABLE 3
The number of days on which each species of solitary wasp and bee was recorded at Blaxton Common in the Archer sample

No. records	No. days	Species	No. species
29	1	*Chrysis angustula*, *Priocnemis schioedtei*, *Ancistrocerus parietinus*, *A. trifasciatus*, *Trypoxylon clavicerum*, *Crabro cribrarius**, *Crossocerus tarsatus*, *C. nigritus*, *Psen lutarius*, *Psenulus pallipes*, *Pemphredon lethifer*, *Diodontus minutus**, *D. tristis**, *Passaloecus gracilis*, *P. singularis*, *Gorytes quadrifasciatus*, *G. tumidus*, *Colletes daviesanus*, *C. succinctus**, *Hylaeus communis*, *H. confusus*, *H.brevicornis*, *Andrena angustior*, *A. barbilabris**, *Halictus rubicundus*, *H. tumulorum*, *Lasioglossum fratellum*, *L. punctatissimum*, *Megachile circumcincta*.	29
34	2	*Hedychridium ardens**, *Arachnospila anceps*, *A. trivalis*, *Anoplius concinnus*, *Episyron rufipes*, *Trypoxylon figulus*, *Crossocerus palmipes*, *C. wesmaeli*, *Psen dahlbomi*, *Pemphredon lugubris*, *Andrena saundersella*, *A. varians*, *Lasioglossum nitidiusculum*, *Megachile versicolor*, *Nomada fabriciana*, *N. ruficornis*, *N. rufipes**.	17
36	3	*Chrysis impressa*, *Priocnemis exaltata*, *Arachnospila spissa*, *Ectemnius continuus*, *Colletes fodiens*, *Andrena denticulata**, *A. praecox*, *Lasiogalossum leucopum*, *Sphecodes gibbus*, *Megachile willughbiella*, *Nomada flavoguttata*, *Epeolus variegatus*.	12
36	4	*Myrmosa atra*, *Anoplius viaticus**, *Crossocerus ovalis*, *Entomognathus brevis*, *Oxybelus uniglumis**, *Mellinus arvensis**, *Lasioglossum leucozonium*, *Sphecodes puncticeps*, *Nomada goodeniana*.	9
35	5	*Trichrysis cyanea*, *Andrena clarkella**, *A. fulva*, *A. tibialis*, *Lasioglossum rufitarse*, *L. villosulum*, *Nomada leucophthalma**.	7
18	6	*Lasioglossum calceatum*, *Sphecodes pellucidus**, *Nomada marshamella*.	3
7	7	*Tachysphex pompiliformis**.	1
48	8	*Evagetes crassicornis*, *Crossocerus quadrimaculatus*, *Ammophila sabulosa**, *Andrena chrysosceles*, *A. scotica*, *A. subopaca*.	6
36	9	*Pompilus cinereus**, *Andrena haemorrhoa*, *A. nigroaenea*, *Sphecodes monilicornis*.	4
10	10	*Andrena bicolor*.	1
11	11	*Sphecodes fasciatus*.	1
15	15	*Andrena minutula*.	1

*Local species in Watsonian Yorkshire.

From the Archer sample, the solitary bee species were recorded during the spring and summer months, being more frequent during the spring months (Table 4). May (for the

spring species) and August (for the summer species) were the most productive months for the number of species and individuals. The number of new species was most frequent during the first month of emergence: April for the spring species and June for the summer species. Typical spring species were the mining bees, *Andrena*, with their cleptoparasites, *Nomada*, e.g. *A. haemorrhoa* with *N. ruficornis* and *A. nigroaenea* with *N. goodeniana*. Typical summer species were the mining bees, e.g. *Colletes fodiens* with its cleptoparasite *Epeolus variegatus*, *Andrena denticulata* with *Nomada rufipes*, *Lasioglossum villosulum* with *Sphecodes puncticeps* and the aerial nesting *Megachile willughbiella*. Some bee species were found in the spring and the summer having passed through two generations, e.g. *Andrena minutula* with *Nomada flavoguttata*, *A. bicolor* with *N. fabriciana* and *Lasioglossum calceatum* with *Sphecodes monilicornis*.

TABLE 4
The number of species, new species and individuals of solitary wasps and bees recorded per month at Blaxton Common from the Archer sample

	April	May	June	July	August	September
Wasps						
No. species	0	0	19	20	32	7
No. new species	0	0	19	9	15	0
No. individuals	0	0	28	31	50	9
Bees						
No. species	22	24	21	11	17	13
No. new species	22	6	8	4	6	2
No. individuals	32	56	32	24	31	22

Quality Assessment of Solitary Species

Six species are nationally scarce species (Falk, 1991). One species, *Andrena tibialis*, which is a category A scarce species, reaches the northern boundary of its British distribution in Watsonian Yorkshire. The other five species, which are category B scarce species, are either at the northern boundary of their distribution (*Priocnemis schioedtei*, *Nysson trimaculatus*, *Andrena varians*) or are more widespread in Britain (*Crossocerus palmipes*, *Nysson dimidiatus*). No nationally rare species (Falk, 1991) have been found.

Ten species are rare in the context of Watsonian Yorkshire (Archer, 1993) (*Episyron rufipes*, *Tachysphex unicolor*, *Crossocerus palmipes*, *Psen lutarius*, *Diodontus luperus*, *Nysson dimidiatus*, *N. trimaculatus*, *Hylaeus brevicornis*, *Andrena tibialis*, *Sphecodes puncticeps*).

There are 27 species of solitary wasps and bees, which although not rare in Watsonian Yorkshire, have a local distribution, being more or less restricted to sandy habitats (Archer, 1994a). Eighteen of these local species are found at Blaxton Common and except for *C. peltarius* are indicated in Table 3.

The 109 species of solitary wasps and bees can be considered to have a common, frequent, occasional or rare status in Watsonian Yorkshire (Archer, 1993) (Table 5). By giving each species a score depending on the above statuses, including a higher score for the nationally scarce species, a quality score of 341 can be calculated (Table 6). Dividing the quality score by the 109 species gives a species quality score of 3.1.

Ball (1992) proposed a status category scheme for invertebrates in a national context (Table 7). Since such a status coding has not previously been applied solely to the aculeate Hymenoptera of a particular locality the following proposals can be made. The nationally rare and scarce statuses will remain the same as previously considered. The regionally notable species are equated with the regionally rare species. Ball (1993, *pers. comm.*) defined the term "local" as a species either restricted to a particular habitat type or to a particular geographical area, or to widespread species which are intermediate in status

between common and scarce species. At present there is no objective way of assigning a common or local status to the species of the British aculeate Hymenoptera. From personal experience I have therefore assigned common or local status based upon abundance and distribution within England and Wales. Ireland was excluded as little information is available on Irish distributions, as were the Channel Islands, since their fauna relates more to France than to the British Isles, and Scotland, because its cooler climate has a profound effect in reducing the diversity of aculeate Hymenoptera. Using the Ball national status scheme a quality score of 209 and a species quality score of 1.9 can be calculated (Table 7).

TABLE 5
The regional coding of the 109 species of solitary wasps and bees recorded from Blaxton Common

Status	No. species
Common	42
Frequent	34
Occasional	23
Rare	10

TABLE 6
The regional quality score of the species of solitary wasps and bees recorded at Blaxton Common

Status	Status Score (A)	No. species (B)	Quality Score (A*B)
Common	1	41	41
Frequent	2	34	68
Occasional	4	22	88
Rare	8	6	48
Nationally Scarce	16	6	96

TABLE 7
The Ball national quality score of the species of solitary wasps and bees recorded at Blaxton Common

Status	Status Score (A)	No. species (B)	Quality Score (A*B)
Common	1	65	65
Local	2	32	64
Regionally notable	4	6	24
Scarce B	8	5	40
Scarce A	16	1	16

Two objections can be raised against the Ball national status scheme. Firstly, since regionally notable species are unknown for many parts of England, Ball's scheme cannot be applied. Secondly logically a national scheme should give a species status based upon that species' importance in a national and larger geographical setting but not in a smaller or regional distribution.

To overcome the above objections I suggest the following scheme in which the statuses of "Common" "Local" and "Regionally Notable" of Ball are replaced by: "Universal" "Widespread" and "Restricted". These new statuses are assigned from personal experience of a species' abundance and distribution within England and Wales. Universal species would be common species found throughout England and Wales, which usually extend into

Scotland. Widespread species would be found in about three-quarters of England and Wales, usually with a distribution in Wales, southern and midland England or in northern and western England and Wales. Widespread species also may be found throughout England and Wales but either with a local distribution or a less than common abundance. Restricted species would mainly be found in about one-half of England and Wales, usually confined to southern England and East Anglia. Using this new national status scheme, a quality score of 205 (Table 8) and a species quality score of 1.9 can be calculated for Blaxton Common.

Cleptoparasitic Load

The cleptoparasitc load (CL) is the percentage of aculeate species that are cleptoparasites on other host aculeates (Table 9). At Blaxton Common the CL for the species of solitary bees is higher than the CL for the species of solitary wasps.

Aerial Nester Frequency

The aerial nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nests are often in old beetle burrows in dead wood or the central cavities of stems such as those of bramble. Subterranean nesters nest in the soil, usually in burrows dug by themselves but sometimes in crevices or pre-formed burrows (Table 10). The AF for the species of solitary wasps is higher than the AF for the species of solitary bees at Blaxton Common.

TABLE 8

The Archer national quality score of the species of solitary wasps and bees recorded at Blaxton Common

Status	Status Score (A)	No. species (B)	Quality Score (A*B)
Universal	1	59	59
Widespread	2	43	86
Restricted	4	1	4
Scarce B	8	5	40
Scarce A	16	1	16

TABLE 9

The relative frequency of the cleptoparasitic species among the solitary wasps and bees from Blaxton Common

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic Load CL=100*C/(H+C)
Solitary Wasps	51	9	15.0
Solitary Bees	36	13	26.5

TABLE 10

The nesting habits of the host solitary wasp and bee species from Blaxton Common

	No. aerial nesters (A)	No. subterranean nesters (B)	Aerial nester frequency AF=100*A/(A+S)
Solitary Wasps	22	29	43.1
Solitary Bees	5	31	13.9

TABLE 11

A comparison of the quality scores of sandy habitats in Watsonian Yorkshire and elsewhere in England based on the species of solitary wasps and bees.

	Sherwood Forest	Pre-coniferized Allerthorpe Common	Charnwood Forest	Strensall Common	Coniferized Allerthorpe Common	Pompocali	Blaxton Common	Risby Warren	Swincarr Plantation	Skipwith Common
Area (ha)	390	2030	11,650	690	2030	1.7	150	170	0.05	312
No. species	100	129	147	91	75	51	109	63	35	69
Regional scheme										
Quality score	–	514	–	289	212	136	341	–	74	149
Species quality score	–	4.0	–	3.2	2.8	2.7	3.1	–	2.1	2.2
Ball's national scheme										
Quality score	290*	381	402**	213	167	112	209	119*	57	105
Species quality	2.9	3.0	2.7	2.3	2.2	2.2	1.9	1.9	1.6	1.5
Archer's national scheme										
Quality score	296	379	402	225	175	115	202	114	62	109
Species quality score	3.0	2.9	2.7	2.5	2.3	2,3	1.9	1.8	1.8	1.6

* Regional notable species based on Watsonian Yorkshire
** Regional notable species based on Archer (1990)

Discussion

Quality Assessment

The regional and national status schemes of Ball and Archer can be applied to other sandy localities in Watsonian Yorkshire (Archer, 1984, 1985, 1988, 1989, 1992b), Lincolnshire (Risby Warren, Archer, 1994b), Nottinghamshire (Sherwood Forest, Archer, in press) and Leicestershire (Charnwood Forest, Archer, 1992a) (Table 11). The sandy habitats vary greatly in size from the sand pit at Swincarr Plantation to the eroded Precambian mountain range of Charnwood Forest. The number of species of aculeate wasps and bees varies from 35 species at Swincarr Plantation to 147 species at Charnwood Forest.

The quality and species quality scores of the Ball and Archer national status schemes for each locality are of a very similar or even of the same value (Table 11). Blaxton Common on its species quality score is ranked seventh on the Archer scheme and equal seventh with Risby Warren on the Ball scheme out of the ten data sets. Both schemes would seem suitable as a national status scheme but the Archer scheme is preferred for reasons given earlier.

For the seven Yorkshire localities the regional and Archer national species qualities scores show a significant linear positive relationship (correlation coefficient, $r = 0.87$, $p<0.02$). Similarly the regional and Archer national quality scores show a highly significant linear positive relationship ($r = 0.98$, $p<0.001$). At present these relationships cannot be explored outside Watsonian Yorkshire as regional statuses for other parts of England are not yet available. The regional species quality and quality scores are higher for each locality than the Archer national scores (Table 11) because there are four, rather than three, statuses before the national scarce species (Tables 6, 8).

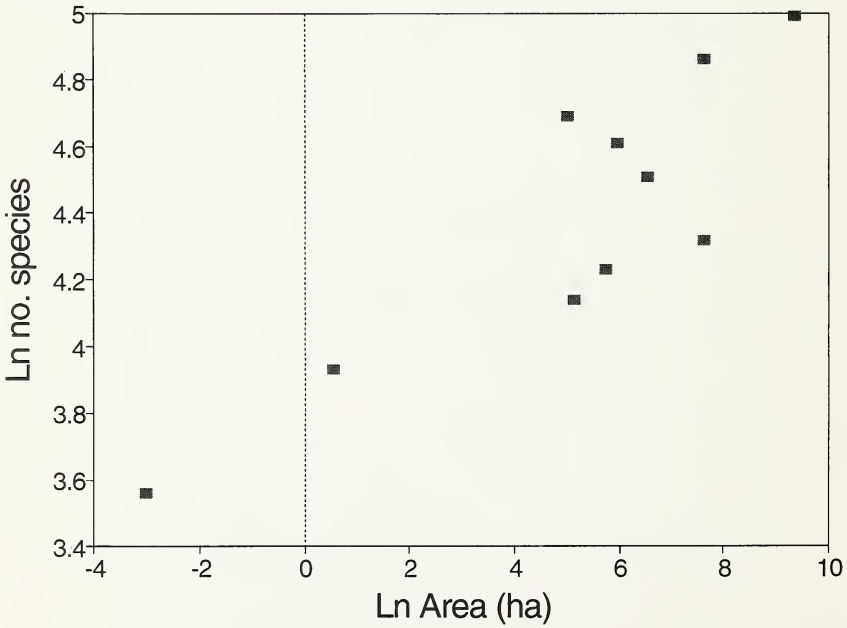

FIGURE 1

The Ln number of species versus Ln area (ha) of the species of solitary wasps and bees recorded from sandy habitats in Watsonian Yorkshire and elsewhere in England.

For each locality the Archer national quality score shows a highly significant linear positive relationship with the number of species ($r = 0.95$, $p=0.001$). This relationship is a reflection of a species-area relationship. Thus the larger the area of the locality the more species are present, including an increased chance of nationally scarce and rare species being found. A plot of Ln number of species versus Ln area in hectares gives a highly significant relationship ($r = 0.87$, $p=0.001$) (Figure 1). Removing the data for coniferized Allerthorpe Common, which is a damaged habitat (Archer, 1989), increases the significance of the species-area relationship ($r = 0.92$, $p<0.001$) and gives the species-area equation: $LnS = 3.85 + 0.11\ LnA$, where S = number of species and A = area in hectares.

Cleptoparasitic Load & Aerial Nester Frequency

The wasp and bee cleptoparasitic loads are similar to values from other sandy localities (Archer, 1992b, 1993).

Likewise, the wasp and bee aerial nester frequencies are similar to lowland heaths such as pre-coniferised Allerthorpe and Strensall Commons (Archer, 1992b).

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BOOK REVIEWS

Aliens in the British Isles by **R. Gwynn Ellis**. British Plant Life no. 2. National Museum of Wales, Cardiff. 1993. £3.50.

This is another well illustrated booklet from the National Museum of Wales, which provides an introduction to some 40 species of alien plants which have been deliberately and/or accidentally introduced into the British Isles. The species cover a wide range from bulbs and herbaceous plants to shrubs and trees; both old (Corn Marigold) and new (New Zealand Pigmyweed) arrivals to the country are featured. The effects of some of the more invasive species, such as Rhododendron and Japanese Knotweed, are dealt with in the introductory text. Each plant (given its English, Welsh and scientific names) is described briefly and its British and world distributions provided by maps, the latter showing the plant's origin. It is to be hoped that further books in this series will be produced. Recommended both for beginners and the more serious botanist.

DRG

Drought follows the Plow: cultivating marginal areas edited by **M. H. Glantz.** Pp. viii + 197 including 38 figures. Cambridge University Press. 1994. £25.00 hardback, £12.95 paperback.

Human interference is all too often detrimental to our environment. Changes in land use ostensibly intended to improve human welfare, but often initiated through ignorance, are particularly insidious. A century ago a belief that ploughing, cultivation and tree planting could increase local rainfall, gave rise to the phrase 'rain follows the plough'. In fact the reverse is the case, especially in marginal lands where the risk of crop failure in any given year is relatively high. Here climatic variability encourages exploitation in periods of adequate rain, to be followed by disaster in dry periods. The result is environmental degradation, destruction of ecosystems, or even complete desertification.

This little book presents background information on marginal lands and gives case histories of their abuse from the Great Plains of N. America, N.E. Brazil, Australia, the 'virgin lands' of the former Soviet Union, and half a dozen areas of Africa. All are depressingly similar. Vast areas are involved: between 1954 and 1958 an area three times that of Britain was put into cultivation in the virgin lands scheme on the basis of experience in the better-watered Ukraine and of wishful thinking. Furthermore, some areas were already being used sensibly by pastoralists. Elsewhere, inappropriate and destructive technology contributed to the damage of land that was simply unsuited to the kinds of exploitation envisaged, and everywhere in developing countries rapid increases in human populations exacerbate the problems. African National Parks, perhaps best exploited by game animals, are also threatened. Their salvation may be to share the profits of tourism with local populations. In the Great Plains of N. America reversion of some areas to grassland populated by Bison may be the best solution.

Climatic variability in marginal lands is now well known but is regularly ignored by 'developers' and governments who could benefit more from the knowledge of ecologists and naturalists than is often the case. Lessons are also to be learned from 'backward' societies which have often accommodated themselves to nature and its rhythm. Anyone concerned with the careful management of our planet, not least policy makers, could read this book with profit and should keep in mind that global warming may impose additional stress on these fragile areas in the future.

GF

SOME RECORDS OF FEATHER MITES (ACARI: ASTIGMATA) IN YORKSHIRE

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Introduction

Feather mites are members of the Acari, belonging to the group Astigmata. They have neither stigmata or trachea. The gnathosoma is clearly visible from above. The idiosoma is divided by the sejugal furrow into the anterior propodosoma and the posterior hysterosoma. Both the propodosoma and the hysterosoma bear sclerotized shields. The coxa are fused to the ventral surface of the idiosoma forming apodemata. The anus is ventral and, in the male, is usually flanked by the adanal discs. The legs generally comprise six free segments, and include the ambulacrum – a bell-shaped sucker typically surrounding a very small claw.

The only recorded studies of feather mites in northern England were undertaken by the Rev. John Edward Hull (1863-1960), who completed his studies in Northumberland and Durham (Hull 1934), and by Mr Harold (Harry) Britten (1870-1954), who worked only in Lancashire and Cheshire. There are no records of feather mites in Yorkshire.

Materials and Methods

In order to collect the mites from bird feathers, the primaries, secondaries and retrices were removed and examined individually under a stereo microscope. Mites were then transferred, using a fine brush, into a drop of mountant on a slide and covered with a cover-slip. The mountant used was polyvinyl lactophenol which had the benefit of clearing the mites to allow a thorough examination. The remaining feathers were then examined *in situ* using the stereo microscope and the resulting mites mounted as before. Once the mites had cleared they were identified using a compound microscope with magnifications ranging from 100x to 400x (and very occasionally 1000x).

Host Birds and Collection Localities

A. Bilton in Ainsty, SE4749, Swallow *Hirundo rustica* Linnaeus.
B. Bilton in Ainsty, SE4749, Magpie *Pica pica* (Linnaeus).
C. Bramham, Headley Hall Farm, SE4441, House Sparrow *Passer domesticus* (Linnaeus).
D Castleford, SE4325, Collared Dove *Streptopelia decaocto* Frivaldszky.
E. Chapel Allerton, Leeds, SE2937, Great Tit *Parus major* Linnaeus.
F. Drighlington, SE2228, House Sparrow *Passer domesticus* (Linnaeus).
G. Huddlestone Wood, Sherburn in Elmet, SE4633, Pheasant *Phasianus colchicus* Linnaeus.
H. Malham, SD8966, Rook *Corvus frugilegus* Linnaeus.
I Mickletown Ings, SE3927, Mute Swan *Cygnus olor* Gmelin.
J. Swinsty Reservoir, Washburn Valley, SE1952, Jay *Garrulus glandarius* (Linnaeus).
K. West Ardsley, SE2724, Blackbird *Turdus merula* Linnaeus.
L. Willow Garth, Knottingley, SE5124, Starling *Sturnus vulgaris* Linnaeus.

Species List – Acari

Family Analgesidae	
Analgopsis mucronatus (Buchholz)	E.
Analgopsis tridentulatus (Haller)	L.
Megninia ginglymura (Mégnin) (Gaud, Atyeo & Barre 1985)	G.
Diplaegidia columbae (Buchholz)	D.
Family Alloptidae	
Trouessartia rosterii (Berlese) (Santana 1976)	L.

Family Dermoglyphidae	
Falculifer rostratus (Buchholz) (Dubinin 1951)	D.
Family Proctophyllodidae	
Brephosceles anatina Dubinin (Peterson 1971)	I.
Proctophyllodes corvorum Vitzhum (Atyeo & Braasch 1966)	H.
Proctophyllodes glandarinus (Koch)	J.
Proctophyllodes musicus Vitzhum	K.
Proctophyllodes picae (Koch)	B.
Proctophyllodes stylifer (Buchholz)	E.
Proctophyllodes troncatus Robin	C; F.
Montesauria cylindrica (Robin) (Park and Atyeo 1971)	B.
Family Pterolichidae	
Pteronyssoides obscurus (Berlese)	A.
Pteronyssoides truncatus (Trouessart)	L.
Gabucinia delibata (Robin)	H.

Acknowledgements

I would like to thank Dr Anne Baker and Mr Colin Howes for checking for Yorkshire records; Dr Sandy Baker for his continued help and encouragement; Mr Mike Smith for his help in the laboratory in preparing specimens; Mr C. W. Pettitt of Manchester Museum for access to the Britten collection of mites and the many friends who assisted by collecting the avian specimens.

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A SUB-FOSSIL RECORD OF *POMATIS ELEGANS* (MÜLLER), A MOLLUSC PREVIOUSLY UNRECORDED IN THE EAST RIDING OF YORKSHIRE

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Pomatias elegans (Müller 1774) is a Mediterranean and west European snail with a restricted, mainly southern, distribution in the British Isles (Kemey and Cameron 1979). In December 1993 the authors discovered two shells of *Pomatias elegans* in Brantingham Dale in the former East Riding of Yorkshire (Watsonian vice-county 61). Only a small number of northern stations are known, the nearest to Brantingham being in the North Riding at Forge Valley (Kerney 1968).

Brantingham Dale is a 2km long valley running approximately north-east to south-west, on the south western scarp slope of the Yorkshire Wolds. The valley, although now largely planted with woodland, still retains a good chalk grassland flora and is designated a Site of Special Scientific Interest (SSSI). The shells were found low down on the valley side (SE 945308) in an area closely covered with a secondary woodland growth consisting mainly of sycamore (*Acer pseudoplatanus*) and ash (*Fraxinus excelsior*). Most of the ground surface was unvegetated with a layer of leaf litter covering a chalk scree slope. Dog's mercury (*Mercurialis perennis*) occurred in patches, particularly higher up the slope. The presence of occasional cowslip (*Primula veris*) plants suggests that the canopy may have been more open at some time in the past. A few tens of metres north of the site there is a band of herb-rich chalk grassland extending from the floor to the rim of the valley.

The site held a relatively rich snail fauna: a list of all species recorded is contained in Table 1. The two original shells of *P. elegans* were found, in close proximity, in the leaf litter. Further searches of the site have provided seven more shells. In an attempt to locate live specimens the valley was visited on a mild, wet morning in May 1994, but although many molluscs were active, no live specimens of *P. elegans* were seen.

P. elegans has not previously been recorded in the East Riding although Petch (1904) considered the Wolds to be a suitable habitat; the Brantingham Dale area has been well worked by conchologists since his time but no records of this species have been made. In view of the potential importance of this find, the Yorkshire Naturalists' Union mollusc recorder, Mr A. Norris, was sent one of the specimens. The identification of the specimen was confirmed but Mr Norris, after consultation with the National Recorder, Dr Kerney, believed the specimens to represent sub-fossil shells originating from a wash-out in the chalk scree.

TABLE 1.
List of snails determined from shells found on the wooded scree slope Brantingham Dale.

Pomatias elegans (Müller)	**Oxychilus cellarius* (Müller)
Carychium tridentatum (Risso)	*Cecilioides acicula* (Müller)
Cochlicopa lubricella (Porro)	**Cochlodina laminata* (Montagu)
Vertigo pygmaea (Draparnaud)	**Clausilia bidentata* (Ström)
Pupilla muscorum (Linné)	*Helicella itala* (Linné)
Vallonia costata (Müller)	**Trichia striolata* (Pfeiffer)
Vallonia excentrica Sterki	**Arianta arbustorum* (Linné)
Discus rotundatus (Müller)	**Cepaea nemoralis* (Linné)
Vitrea contracta (Westerlund)	

* *indicates species seen as live animals, others determined only from empty shells.*

Although Brantingham Dale only appears to represent a former station of the species, the record is still of considerable interest. Examination of the distribution map for the species (Kemey 1972) reveals that the site fills a gap in the distribution of the species between its northern limit in Forge Valley and former stations in Lincolnshire. It also raises the possibility that the species may still be found on the Yorkshire Wolds.

The robust nature of the *P. elegans* shell and its burrowing habit mean that shells can persist in the soil for many thousands of years. Indeed, specimens dating from the Bronze Age have been found at Castlethorpe in the Ancholme valley, Lincolnshire, a little over 20km to the south of this site (Preece & Robinson 1984). It may be noteworthy that all of the shells were found on the lower third of the valley side, indicating that a considerable period of soil creep may have modified a more even distribution over the slope.

In Britain *Pomatias elegans* occurs in a variety of calcareous habitats but shows a preference for limestone banks with a certain amount of scrubby cover and a rubbly substrate in which to burrow (Kemey 1972, Cameron & Redfem 1976). As previously noted, there is some botanical evidence to suggest that the site was once more open than at present. The list of shells recovered from the site (Table 1) reveals many species typical of dry open sites rather than of woodland. This is exemplified by the discovery of two worn shells of *Helicella itala*, another species which is now in decline. It would be tempting to suggest that it was changes in vegetation that made the area unsuitable for *Pomatias elegans*. This may be true in a very local sense but the valley as a whole still has open habitats which would be expected to be suitable. *Pomatias elegans* is known to have declined in many parts of Britain (Kemey 1972) and is considered to be virtually extinct over the whole of East Anglia and Lincolnshire (A. Norris *pers. comm.*). It is thought that human disturbance and long term climatic changes, particularly a greater incidence of frost, may be responsible (Kemey 1968).

Acknowledgements

The authors are indebted to Mr A. Norris of Leeds City Museum for his helpful comments and confirmation of shell identifications.

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VERTIGO GEYERI (LINDHOLM 1925), A SNAIL NEW TO YORKSHIRE

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On 21 May 1994, during the YNU excursion to the Law Dalby area, a single live specimen of *Vertigo geyeri* (Lindholm 1925) was found in the marshy area at Ellers Springs SSSI (SE44/857849) by the author. Initially this was erroneously recorded as a juvenile specimen of *V. antivertigo* (Drap.). Subsequently, a site list was received by the author form A. A. Wardhaugh in which he recorded *V. pygmaea* (Drap.). The original specimen was then re-examined and showed some marked differences to *V. antivertigo*. The specimen was then forwarded to Dr M. P. Kerney at The Natural History Museum, London who confirmed that it was in fact *V. geyeri*, a new county record.

This record is only the third for this species from Britain, the others being Tarn Moor, Cumbria (Coles & Colville 1978) and Cors Erddreiniog, Anglesey (Colville 1994). It is known from several sites in Central Ireland (Norris & Pickrell 1972), and is of local occurrence in the remainder of Europe. This new record therefore extends its eastern range within the British Isles.

Due to the interesting nature of the discovery the site was revisited on 19 September 1994. Weather condition on both dates were very wet. Ellers Springs is at an altitude of 60-65 metres and consists of several springs emerging from the higher ground and flowing over blocks of Jurassic limestone towards a shallow man-made pool. The areas between the flowing water remain wet throughout the year and there are small tufaceous deposits scattered throughout it. An unmettled track, which runs north to south, conveniently splits the area in two, both sides of which have good sedge and rush growth, including *Shoenus nugricans* L. and *Carex lepidocarpa* Tausch, interestingly recorded from all *V. geyeri* sites in Britain. Other species of interest are *Carex panicea* L. and *Carex dioica* L., which have also been recorded from the Tarn Moor site (Coles & Colville 1979). All four species were growing on the western side of the track, where the original specimen was found.

This area was re-examined and a further three live specimens of *V. geyeri* were found in clumps of sedge growing on tufaceous deposits. A very small quantity of litter was removed by Dr B. Colville and when dried and sifted, this yielded a further 9 specimens. This area is referred to as Site A in Table 1.

The higher ground on the east of the track was also examined (site B in Table 1). This area is of a more acid nature (D. R. Grant, *pers. comm.*) and did not produce any specimens of *V. geyeri* although it did not show some similarities to site A. The third area examined (site C in Table 1) was again on the eastern side and only slightly more elevated than site A. This site was much wetter and had a smaller quantity of sedge and large quantities of moss. Once again no specimens of *V. geyeri* were found. The last area to be examined (site D in Table 1) on the immediate eastern side of the track showed the closest similarity to site A. No specimens were found at the time but a small amount of litter later revealed a single dead shell of *V. geyeri*.

V. geyeri appears to be very limited in its distribution at this site, being restricted to an area some 20 x 20 metres on the west side of the track. I do not believe that the single dead shell found at site D was accidentally introduced by floods, as any debris would wash east to west. *V. geyeri* appears to be highly specific in its choice of microhabitat, being found amongst sedge growing on tufaceous deposits in areas with no moss growth about the bases of the plants. It also appears to be absent form the extremely wet areas in which other *vertiginidae* are to be found. A further examination of similar sites in the area to establish its presence or absence would be of great interest. Any specimens of *Vertiginidae* found in such areas should be carefully examined.

A full list of associated mollusca found at sites A to D is given in Table 1.

I would like to thank Dr B. Colville and Mr A. Norris for their assistance and

encouragement in the preparation of this note and Dr M. P. Kerney for verifying the original specimen. I would also like to thank Dr. Clayton of English Nature for permission to revisit the site.

TABLE 1
Associated Mollusca at Ellers Springs

	A	B	C	D
Lymnaea truncatula	*	*	*	*
L. peregra			*	
Carychium minimum	*	*	*	*
C. tridentatum	*	*		
Oxyloma pfeifferi	*	*	*	*
Cochlicopa lubrica	*		*	
Vertigo antivertigo	*	*	*	*
V. substriata	*		*	*
V. pygmaea	*			*
V. geyeri	*			*
Leiostyla anglica	*	*		
Vallonia pulchella	*			
Punctum phygmaeum	*	*	*	*
Arion intermedius	*			
Vitrea crystallina	*			*
Nesovitrea hammonis	*	*	*	*
Deroceras laeve	*			
Euconulus alderi	*	*	*	*
Trichia hispida			*	

A = west side of track
B, C, D = east side of track
B = Higher ground
C = Wetter area next to wall
D = Area immediately to east of track

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ROAD VERGE HALOPHYTES IN S.E. YORKSHIRE

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Summary

The de-icing of roads with rock salt has resulted in a large number of records for halophytic plants from the major road and motorway network over the British Isles. During 1994 records for several maritime species were gathered from the verges of salt-treated minor roads in the Holderness area of S.E. Yorkshire. The presence of such populations alongside relatively quiet minor roads has enabled preliminary observations to be made about their distribution and hypotheses to be proposed regarding the mechanisms by which they are dispersed. The ecological significance of the deliberate pollution of some the last remnants of permanent grassland in an intensively farmed area of the region is noted.

Introduction

For several years I have been recording the presence and persistence of Danish Scurveygrass (*Cochlearia danica* L.) along the verges and central reservations of trunk roads and motorways in counties south of Yorkshire, but have not taken much notice of what has been happening near home. Late in 1993 I noted Sea Aster (*Aster tripolium* L.) growing by the A63 to the west of Hull, an event which stimulated me to look for other maritime species along road verges in the Hull area.

When I first started my searches, in May 1994, I believed that halophytes were to be found only on the verges and central reservations of salted trunk roads. I have now changed this belief. So far I have noted *Aster tripolium*, Grass-leaved Orache (*Atriplex littoralis* L.), Lesser Sea-spurrey (*Spergularia marina* (L.) Griseb.) and Reflexed Saltmarsh-grass (*Puccinellia distans* (Jacq.) Parl.) by the side of salted 'B' class and minor roads in Holderness. In addition, I have found *C. danica* on trunk roads to the west of Hull, probably the first inland records for *C. danica* in V.C. 61. Another interesting find is the *intermedia* subspecies of *Plantago major*, a subspecies with a predeliction for saline habitats.

The following list of records leads to a discussion about the possible methods of spread within the Holderness area and the ecological consequences of de-icing with rock salt.

Aster tripolium

The A63 populations of this species were sprayed by highway maintenance workers early in 1994 but I have since recorded it on the verge of the recently constructed Hedon bypass in Holderness [TA12]. These first-year plants are vulnerable to roadside verge cutting and are unlikely to flower and fruit in 1995. Coincidentally I found Foxtail Barley (*Hordeum jubatum* L.). This alien species from North America is usually introduced onto roadside verges by the sowing of grass seed mixes and it persists where there is salt.

Atriplex littoralis

In two places [both TA22], plants were found in 'grips' (shallow drainage channels cut at a right angle to the road edge) in which sand and grit had accumulated to form a 'micro dune'. In two other places [both TA32] the plants were growing together with Spear-leaved Orache (*Atriplex prostrata* Boucher ex DC.) on disturbed bare soil where cars are frequently parked by the roadside.

Spergularia marina

This species was found in the same locations as the *Atriplex littoralis* and occupied areas of the road verge which are persistently wet for most of the growing season, for example in wheel ruts and gulleys in silt caused by running water. In general, records for this were found while investigating other species and it is possible that it is more widespread than I currently know.

S. marina was found growing 'behind' *P. distans* and in three places occurred in considerable quantity in a small area suggesting that it had persisted there for at least one fruiting season.

I have found *S. marina* forming continuous dense strips along the road verge south of Carter Bar high on the Cheviots. Here it grows along the edge of gulleys where water has coursed down the road verge, suggesting that running water is a principal method of spread in this species. Holderness is markedly short of inclines so I do not expect *S. marina* to become as widely distributed as *P. distans*.

Puccinellia distans

This species occurs in near-continuous strips along the verges of salted minor roads throughout Holderness, along the A63 and M62 and along some roads to the east side of the Wolds (Driffield, Beeford, Bridlington etc.). It is so widespread along the salted minor roads that I can hypothesize on its dispersal (see Discussion).

Cochlearia danica

Early in May I noted *C. danica* by the M180 near Grimsby and then on the A15 approach to

the Humber Bridge in V.C. 54. As my journey progressed in V.C. 61 I found some near Hessle, not far from the Humber Bridge [TA02]. I believe that *C. danica* has entered V.C. 61 via the Humber Bridge rather than along the M62/A63. Later in the month I found it by an exit slipway from a service station on the west-bound carriageway of the A63 near Swanland/Ferriby [SE92] and then in considerable quantity along the eastbound carriageway of the M62 near Howden/Saltmarshe Grange [SE72]. In all of these places plants were seen on the nearside verge at, and for a short distance after, the emergence of a slip road onto the carriageway.

Plantago major subsp. intermedia

This unusual plant occurs on Spurn [TA41] and on the splash and spray zone of the sea defences and promenades at Withernsea [TA32]. I have found it as a road verge species in North Lincolnshire but only late in the 1994 season did I start to find it in Holderness. In both locations it occurred with subsp. *major* but occupied otherwise bare ground just off the road surface itself and in accretions of silt in potholes at the road edge. The *major* subspecies occurred on bare ground further away from the road edge, clearly demonstrating the ecological differences between the two.

Discussion

Preliminary observations on the distribution of *P. distans* on minor roads reveal that it occurs only in places where the verge abuts directly to the road (i.e. no footpaths) and then only where the road surface is level with or higher than the verge. This is an important factor for salt exposure and for the resulting denudation of competitive species along the margin of the road verge. It occurrs equally abundantly on either side of the road, irrespective of the compass-point orientation of the road, suggesting that prevailing wind direction and carriage of caryopses by wind-blown water spray is unlikely to be a factor in the side-relative distribution of populations, as seen on motorways, but may be an important factor in the spread of caryopses with the flow of traffic.

The caryopses are ripe and are already dehiscing by August, just as the flail mowers emerge; this could be the main agency for spreading *P. distans* and perhaps also some of the other road verge species, e.g. *Atriplex prostrata*, which occur extensively along our road verges, both treated and untreated.

P. distans produces a further crop of caryopses in autumn. I suspect that these are spread by motor vehicles which could pick up caryopses in mud and slush on mudflaps and wheel arches, especially on their nearside. Evidence for this is the presence of *P. distans* only on the nearside verge of several unsalted roads for a distance of a few metres from their junction with a salted road. In some respects this situation is analogous to the presence of a seemingly greater abundance of *C. danica* and *P. distans* over a short distance on the nearside verge at the bottom of slip roads onto motorways and at road intersections. In both cases, this zone is where vehicles are accelerating and where the likelihood of lumps of mud and slush to fall away from the vehicle is the greatest.

I believe that motor vehicles themselves are important carriers of seed and caryopses and as the agents of long-distance distribution to form new foci of growth from which spread by other agencies, such as flail mowing, wind and spray conditions and carriage by flowing water, then proceeds.

Although it is interesting to make these records, observations and hypotheses, I am aware of the ecological damage that salt de-icing, a deliberate pollution, causes. The road verges of Holderness are some of the last remnants of undisturbed neutral grassland in this intensively farmed area. Although the salt-affected verge is only a strip of about half a metre width, it is this zone which has a regularly-maintained mowing regime (correctly timed or not) and therefore has the most potential for maintaining a diverse flora. For economic reasons, salting is confined to the busier roads and it is still possible to find 'jewels' on some of the back lanes.

This study has caught the situation early with respect to *S. marina* and *A. littoralis*, i.e.

focal populations have only just started to appear and I intend to establish a 'baseline' distribution of these species within selected mapping tetrads during 1995 to enable subsequent spread to be monitored. Continued recording of the spread of what are effective 'salt pollution indicators' is essential in the preparation of justified opposition to salt de-icing.

BOTANICAL REPORTS FOR 1993: FLOWERING PLANTS AND FERNS

Compiled by L. MAGEE

The recorders thank all those who have sent in records. The names of contributors are given in full the first time that they appear in each report, initials being used thereafter. The names of species are in accordance with those used in Stace, Clive A. (1991) *New Flora of the British Isles* and Kent, D. H. (1992) *List of Vascular Plants of the British Isles*.

*Denotes a first v.c. record

EAST YORKSHIRE (VC61) (F. E. CRACKLES)

This report contains additional 10 km x 10 km square records for species of significance and hybrids not previously recorded for more than eleven squares, except where otherwise stated.

Polystichum aculeatum (L.) Roth Roadside ditch, near Molescroft 54/04, 1992; Dews.

Clematis vitalba (L.) Embankment of disused railway, Middleton 44/94; J.D.

Rannuculus aquatilis L. Swine Moor 54/04, 1991; J.D.

R. circinatus Sibth. Pond by Market Weighton Canal, Newport 44/83; Freshwater Biological Section field meeting, per D. Grant.

Fumaria densiflora DC. Arable, Etton Wold 44/94; J.D. conf. Dr. M. G. Daker, per E. Chicken. The first v.c. 61 record for this species as a British native. Previous records: Hull docks, 1902; C. Waterfall: Bridlington 54/16, 1945, E. W. Holder, Herb. LIV are taken to be of casual status.

Myosoton aquaticum (L.) Moench Swine Moor, Beverley 54/04; J.D.

Salix triandra x *S. viminalis* = *S.* x *mollissim* Hoffm. ex Elwert Bank of River Derwent, Wheldrake Ings 44/74; C. D. Preston.

S. viminalis x *S. caprea* = *S.* x *sericans* Tausch ex A. Kerner Bank of River Hull, near Tickton 54/04, 1992; J.D.

Descurainia sophia (L.) Webb ex Prantl Farmland rubbish tip, near Leven 54/04, 1991; J.D.

Barberea stricta Andrz. Drain Bank, near Long Riston 54/14; J.D.

**Rorippa sylvestris* x *R. amphibia* = *R.* x *anceps* (Wahlenb.) Reichb. Marshy grassland, Wheldrake Ings 44/74; C.D.P.

R. amphibia (L.) Besser Flooded excavation, near Eske 54/04; J.D.

Coronopus didymus (L.) Smith Hemingborough 44/63; M. Hunter and arable, Etton Wold 44/94; J.D.

Cakile maritima Scop. Below cliffs, Hornsea 54/24, 1991; J.D.

Oenthera glazioviana Micheli ex C. Martius Gravel pit, Brandesburton 54/14, 1992; J.D.

Geranium pyrenaicum Burman f. Roadside verge, near South Dalton 44/94, 1992; J.D.

Myosotis ramosissima Rochel Gravel pit, near Brandsburton 54/14; J.D.

Mentha arvensis x *M. aquatica* = *M.* x *verticillata* (L.) Wheldrake Ings 44/74; C.D.P.

Callitriche hamulata Kuetz. ex Koch Wheldrake Ings 44/74; C.D.P.

Linaria repens (L.) Miller Embankment of disused railway, near Leconfield 54/04, 1991 and disused chalk quarry, Goodmanham 44/94; J.D.

Centaurea cyanus L. Roadside verge, near Barfhill 54/04, 1992, not re-found, 1993; J. D. This now rare species was in plenty in a cornfield in the same area in 1957; F. E Crackles.

Lactuca serriola L. Beverley 54/04, 1992; J.D. and disused railway, Middleton 44/94; J.D.
L. virosa L. Disused railway, Enthorpe 44/94; J.D.
Aster tripolium L. Frequent by Clive Sullivan Way from just east of the Humber Bridge to William Wright Dock in west Hull 54/02; P. Cook.
Conyza canadensis (L.) Cronq. Disused railway, Goodmanham 44/84 and Middleton 44/94; J.D.
Anthemis cotula L. Roadside verge, near Leven 54/04, 1992; J.D.
Bidens tripartita L. Marshy grassland, Wheldrake Ings 44/74; C.D.P.
**Elodea nuttallii* (Planchon) H. St. John Barmston Drain, Beverley 54/04; J.D. and ditch, Wheldrake Ings 44/74; C.D.P.
Potamogeton perfoliatus L. By bridge over the River Derwent, Wheldrake Ings 44/64; C.D.P.
P. pusillus L. Fishing pond, Newport 44/83; FWBS field meeting, per D.G.
**P. trichoides* Cham. & Schldl. Former course of the River Derwent, and ditch Wheldrake Ings 44/74; C.D.P.
Carex divulsa Stokes subsp. *leersii* (Kneucker) W. Koch Disused railway, near Keyingham 54/22; P.C., det. C. Jermy.
Nardus stricta L. Swine Moor 54/04, 1990; J.D., confirming an old record.
Milium effusum L. Oldflat Wood, Harswell 44/84; M. Whittaker.
Cephalanthera damasonium (Miller) Druce One Plant, disused railway between Gardham and Kipling Cotes 44/94; A. Marshall.
Dactylorhiza fuchsii x *D. purpurella* = *D.* x *venusta* (Stephenson & T. A. Stephenson) Soó Waste ground, Withernsea 54/32; M. Cook.

North-East Yorkshire (VC62) (T. F. Medd)
Ceratophyllum demersum L. Ditch, Rye Mouth 44/87; YNU Fresh Water Biological Section Excn.
Ranunculus penicillatus (Dumort.) Bab. ssp. *pseudofluitans* (Syme) S. Webster Costa Beck 44/87; YNU FWBS Excn.
Chenopodium bonus-henricus L. Roadside, Marishes 44/87; YNU FWBS Excn.
Stellaria neglecta Weihe between R. Rye and Derwent 44/87; YNU FWBS Excn.
S. palustris Retz. Between R. Rye and Derwent 44/87; YNU FWBS Excn.
Sagina nodosa (L.) Fenzl Spaunton Knowl 44/79; YNU Excn.
Silene noctiflora L. Caulkleys, Bank, Nunnington 44/67; T.F.M. Confirmation of old record.
Hypericum elodes L. Spaunton Moor 44/79; YNU Excn.
Lysimachia nummularia L. Between R. Rye and Derwent 44/87; YNU FWBS Excn.
Coronopus squamatus (Forsskål) Asch. Bootham Stray, York 44/65; York & DFN Soc.
Rubus nemoralis P. J. Mueller Hutton Common 44/78 and Lastingham 44/79; YNU Excn. det. D. Grant.
R. ulmifolius Schott Hayburn Wyke 54/09; YNU Bry. Sec. Excn. det. D.G.
R. vestitus Weihe Hutton Common 44/78; YNU Excn. det. D.G.
R. mucronulatus Boreau Buttercrambe Wood, Bossall 44/76; D.G.
R. pallidus Weihe Hutton Common 44/78; YNU Excn. det. A. Newton.
R. dasyphyllus (Rogers) E. Marshall Buttercrambe Wood 44/76; D. G. Hutton Common 44/78; YNU Excn. det. D.G.
R. eboracensis W. C. R. Watson Hutton Common 44/78; YNU Excn. and Hayburn Wyke 54/09; YNU Bry. Sec. excn. det. D.G.
R. warrenii Sudre Hutton Common 44/78; YNU Excn. det. D.G.
Prunus padus L. Troutsdale 44/98; D.G.
Melilotus officinalis (L.) Lam. Banks of R. Dove, Keldholme 44/78; L. Magee
Euonymus europaeus L. Caulkleys Bank 44/67; T.F.M.
Euphorbia exigua L. Caulkleys Bank 44/67; T.F.M. Banks of R. Rye 44/87; YNU FWBS Excn.

Silaum silaus (L.) Schinz & Thell. Hutton Common 44/78; YNU Excn. Between R. Rye and Derwent 44/87; YNU FWBS Excn.
Myosotis secunda A. Murray Strensall Common 44/65; R. Freer.
Verbena officinalis L. Banks of R. Rye 44/87; YNU FWBS Excn.
Lamium confertum Fries Ingleby Greenhow 45/50; V. Jones per J. Blackburn. First record this century.
Clinopodium ascendens (Jordan) samp. Caulkleys Bank 44/67; T.F.M. Confirmation of a pre-1930 record in Atlas.
Veronica catenata Pennell Stream, Bootham Stray, York 44/65; Y&DFNS.
Pinguicula vulgaris L. Spaunton Moor 44/79; YNU Excn.
Utricularia vulgaris L. Still at Strensall Common 44/65; flowered very well in 1993, R. Freer.
Legousia hybrida (L.) Delarbre Set-aside land, Caulkleys Bank 44/67; Y&DFNS. Near Kirkbymoorside 44/78; N. Sykes.
Sherardia arvensis L. Caulkleys Bank 44/67; T.F.M. Hutton Common 44/78; YNU Excn.
Valerianella dentata (L.) Pollich Caulkleys Bank 44/67; T.F.M. Not in atlas but confirmation of 1973 record.
Potamogeton friesii Rupr. R. Rye (at junction with Costa Beck) 44/87; YNU FWBS Excn.
Eleocharis quinqueflora (F. Hartmann) O. Schwarz Tranmire Plain 44/79; YNU Excn.
Carex disticha Hudson Aldwark Moor 44/46; Y&DFNS.
C. dioica L. Tranmire Plain 44/79; YNU Excn.
C. vesicaria L. Rye Mouth 44/87; YNU FWBS Excn.
Melica uniflora Retz. Aldwark Wood 44/46; T.F.M.
Helictotrichon pubescens (Hudson) Pilger between R. Rye and Derwent 44/87; YNU FWBS Excn.
Molinia caerulea (L.) Moench Aldwark Moor 44/46; Y&DFNS.
Typha angustifolia L. Marishes 44/87; YNU FWBS Excn.

South West Yorkshire (VC63) (D. R. Grant)
Equisetum telmateia Ehrh. Old railway, Worborough 44/3303; Dr. L. Lloyd-Evans.
Ranunculus lingua L. Potteric YWT Reserve 44/5900; D. Bramley.
R. circinatus Sibth. Mickletown Flash 44/4027; YNU Freshwater Biological Section Excn.
Carpinus betulus L. Nr. Oughtibridge 43/3192; E. Thompson.
Salix repens L. Kirkthorpe 44/3520; C. Hartley.
Rorippa amphibia (L.) Besser Mickletown Flash 44/4027; D. R. Grant.
Primula vulgaris Hudson Cow Ark, Bowland 34/6943; L.Ll-E.
Rubus tuberculatus Bab. Silcoates, Wakefield 44/3022; D.R.G.
R. warrenii Sudre Gomersal 44/2125; T. Schofield.
R. ulmifolius Schott. Storrs Hill, Ossett; D.R.G.
R. rufescens Lef & P. J. Mueller Worsborough Reservoir 44/3403; D.R.G., det. A. Newton.
R. nemoralis P. J. Meuller Thorpe Marsh YWT Reserve 44/5809; T.S.
R. hylocharis W. R. C. Watson High Bradfield, 43/2692; D.R.G.
R. echinatus Lindley Pildacre Hill, Ossett 44/2620; D.R.G., det. A. Newton.
R. newbouldii Bab. Riverside, Dewsbury 44/2521; D.R.G., det. A. Newton.
R. sprengelii Weihe Beeley Wood, Oughtibridge 43/3192; T.S.
R. scissus W. R. C.Watson St. Ives, Bingley 44/0838; D.R.G.; Chellow Dene, Bradford; 44/1134; T.S.; Thorne Waste Reserve 44/7215; YNU Botanical Section Excursion.
R. plicatus Weihe & Nees Thorne Waste Reserve 44/7215; D.R.G.
Smyrnium olusatrum L. South Elmsall 44/4712; E.T.
Pastinaca sativa L. Shaftholme, nr. Doncaster 44/5609; E.T.
Foeniculum vulgare Miller Normanton 44/3823; D. Procter.
Mentha suaveolens Ehrh. Pildacre Hill, Ossett 44/2620; D.R.G.
Melampyrum pratense L. High Bradfield 43/2692; L.Ll-E.
Inula conyzae (Griess.) Meikle Knottingley 44/4922; D.P.

Lactuca serriola L. Pugney's, Wakefield 44/3218; D.P.
Glyveria notata L. Chevall, Carr Head, Glusburn 34/9744; T.S.
Aira caryophyllea L. Railway banking, Methley 44/3728; T.S.
Vulpia myuros (L.) Gmelin Upton Colliery tip 44/4813; J. Lunn.
*Dactylorchis purpurell*a (Stephenson & T. A. Stephenson) Soó Redbrook tip, near Barnsley 44/3207; J.L.

MID-WEST YORKSHIRE (VC64) (L. MAGEE)

A large number of interesting records were received from all over the vice-county and it is only possible to list a selection here. The recorder thanks the contributors.

Asplenium adantium-nigrum L. Ashlar goits, Barden Moor 44/05; L. Magee.
Phyllitis scolopendrium (L.) Newman Sherburn-in-Elmet 44/4933; E. Thompson.
Ranunculus lingua L. Lowther Pond, Allerton Bywater 44/42; YNU Freshwater Biological Section Excursion.
Clematis vitalba L. Barlow Common 44/6328; E.T.
Actaea spicata L. Penyghent Gill 34/8774; D. R. Grant.
Cerastium arvense L. Bank of River Ouse, York 44/5456; P. Abbott.
Hypericum humifusum L. Stubbings Moor 44/34; P.A.
Salix purpurea L. Hackfall Woods 44/2377; YNU Excn.
Barbarea intermedia Boreau Nr. Hellifield 34/8555; P.A.
Hottonia palustris L. Old Railway, east of Wetherby 44/44; P.A.
Crassula helmsii (Kirk) Cockayne Farnham gravel pit 44/3559; S. J. Evison.
Rufus scissus W. R. C.Watson Adel Valley, Leeds 44/2839; D.R.G.
R. spregelii Weihe Bolton Abbey 44/0755; D.,R.G. Brayton Barff, Selby 44/5830; D.R.G.
R. anisacanthos G. Braun Adel Valley, Leeds 44/2839; D.R.G., det. A.Newton.
R. eboracencis W. R. C.Watson Shipley 44/1638; D.R.G.
R. warrenii Sudre Neat Pateley Bridge 44/1644; D.R.G.
Securigera varia (L.) Lassen Temple Newsam 44/33; L.M.
Myriophyllum spucatum L. Fish Pond, Sherburn-in-Elmet 44/43; L.M.
Epilobium brunnescens (Cockayne) Raven & Engelhorn Goits on Barden Moor 44/05; L.M.
Geranium versicolor L. Malham village 34/96; L.M.
Oenanthe aquatica (L.) Poiret Red House Wood, Moor Mokton 44/5257; P.A., Nether Poppleton 44/5455; P.A.
Lithospermum officinale L. Scotton Banks, Knaresborough 44/3357; D.R.G.
Myosotis stolonifera (D.C.) Gay ex Leresche & Levier Angram Reservoir 44/07; L.M., Scarhouse Reservoir 44/07; L.M.
Limosella aquatica L. Near Staveley 44/3663; D. J. Tennant.
Littorella uniflora (L.) Asch. Barden Reservoir 44/05; L.M.
Veronica anagallis-aquatica L. Strid Wood, Bolton Abbey 44/05; L.M.
Parentucellia discosa L. Caruel Nr. Micklefield 44/4332; P.A.
Cicerbita macrophylla (Willdr.) Wallr. All Alone, Bramhope 44/2342; L.M., King Lane, Alwoodley 44/2841; L.M. Scotland Lane, Horsforth 44/2324; L.M.
Conyza canadensis (L.) Cronq. West Bank of River Ouse, York 44/55; L.M.
Senecio fluviatilis Wallr. Tarn House, Malham 34/86; YNU Excn.
Potomogeton pectinatus L. Nr. Staveley 44/3663; D.J.T.
P. barchtoldii Fieber, Nr. Staveley 44/3663 D.J.T.
Zannichellia palustris L. Ditches nr. Gascoigne Wood sidings 44/53; YNU FWBS Excn., Lowther Pond, Allerton Bywater 44/42; YNU FWBS Excn.
Lemna trisulca L. Lowther Pond, Allerton Bywater 44/42; YNU FWBS Excn.
Carex paniculata L. Beaverdyke Reservoir 44/2154; D.R.G.
Carex strigosa Hudson Hackfall Wood 44/2377: YNU Excn. In new sites and increasing: Loftwood, Bilston-in-Ainsty 44/4748; P.A.
Carex nigra (L.) Reichard var. *juncea* Tarn Fen, Malham 34/86; YNU Excn. conf. D.R.G.

Calamagrostis stricta Koeler Tarn Fen, Malham 34/86; D.R.G., confirmation of old record.
Dactylorchis fuchsii x *D. praetermissa* = *D.* x *grandis* (Druce) P. Hunt Roadside nr. Gascoigne Wood sidings 44/53; YNU FWBS Excn., more than 100 flowering spikes.

Correction to 1986 Report
Ranunculus fluritans L. Collingham 44/42; L. Magee = *R. penicillatus* subsp. *pseudofluitans* (Syme) S. Webster.

North-West Yorkshire (VC65) (T. F. Medd)
Equisetum pratense Ehrh. High Birk Hat, Baldersdale 35/91; M. Sykes.
Primula farinosa L. Deepdale 34/78; A. J. Stoddard.
Potentilla palustris (L.) Scop. Hutton Moor 44/37; Dr. E. Kay.
Limosella aquatica L. Nosterfield 44/27; H. E. Stace.
Campanula glomerata L. Leeming Bar; 44/29; E.K.
Festuca vivipara (L.) Smith Uldale; A.J.S.
Paris quadrifolia L. Dentdale 34/78; A.J.S.

Casuals and Adventives (E. Chicken)
Since the 1992 report, 100 records have been received from five recorders for 60 taxa. More than half of these records are from J. Martin for plants found in the fields treated with shoddy in theWakefield area. A number of our members were able to join the B.S.B.I. recorders field meeting in this area and saw many of the plants that have been listed in this report from year to year. Particularly noteworthy this time are *Hedysarum coronarium* of which it is thought there are only about four confirmed British records since 1930, and *Berkheya rigida*. The following records are a selection of those received. The contributor is assumed to be the determiner unless otherwise stated.

Brassica juncea (L.) Czern. (61) Birdseed alien in garden, Driffield 54/05; E. Chicken.
Fallopia baldschuanica (Regel) Holub (64) near Nessfield, Ilkley 44/04; D. R. Grant.
Tolmiea menziesii (Pursh) Torrey & A. Gray (63) Bankfield near Cottingley Bridge 44/13; D.R.G.
Spiraea douglassii Hook. (63) Filled in mill dams, Holmfirth 44/10; Mrs J. Lucas.
Coronilla scorpioides (L.) Koch (63) Shoddy treated field, Kirkhamgate 44/32; J. Martin, B.S.B.I. meeting per E.C.
Hedysarum coronarium L. (63) Arable, Brandy Carr Farm, Carr Gate 44/32, 1992; J.M. det. E. J. Clement.
Lathyrus grandiflorus Smith (63) Bankside in urban Meltham 44/01; J.L.
Lupinus x *regalis* Bergmans (61) Driffield by-pass 54/058; E.C.
Acer platanoides L. (63) Bank of R. Holme, Holmfirth 44/40; J.L.
Oxalis megalorhiza Jacq. (62) Greenhouse weed, Sutton-under-Whitestonecliffe 44/84; E.C.
Erodium cygnorum Nees 963) Arable, Woodhouse Lane Farm, E. Ardsley 44/22, 1989; J.M. det. E.J.C.
Coriandrum sativum L. (63) Roadside, Meltham 44/10; J.L.
Brunnera macrophylla (Adams) I. M. Johnston (64) Corner of wood, Long Marston 44/95; Mrs P. P. Abbott.
Sambucus racemosa L. (64) Woodland near Hellifield 34/85; P.P.A.
Berkheya rigida (Thunb.) Bolus & Wolley-Dod ex Adams & Salt (63) Arable, Kirkhamgate 44/22; J.M. det. E.J.C.
Scolymus maculatus L. (63) Woodhouse Lane Farm, E. Ardsley 44/22; J.M. conf. E.J.C.
Aponogeton distachyos L.f. (63) By a wharf, Leeds 44/33; P.P.A.

Corrections to 1986 and 1993 Reports:
Eryngium bourgatii Gouan (64) 1986 as redetermined by Dr. A. C. Leslie as *Eryngium giganteum* Bieb.
Solanum sisymbriifolia Lam. (63) 1990 Doncaster was det. J.M. conf. E.J.C.

BOOK REVIEW

Waterfowl Ecology and Management by **Guy A. Baldassarre** and **Eric G. Bolden.** Pp. 609, with many b/w photographs, line drawings and diagrams. John Wiley, New York, 1994. £58.00.

This large volume deals with the waterfowl of North America with an emphasis on the preservation and management of habitats for breeding and hunting, but it is much more than that. For anyone interested in this group of birds beyond the identification level, it is a most fascinating and informative read. In fact, it covers the whole sphere of the group's ecology, including chapters on Classification, Courtship, Reproductive and Feeding Ecology, Major Wetland Habitats, Brood Rearing, Mortality and Harvest Management, this last named chapter including some staggering statistics. For instance, an extensive study in the 1970s by the U.S. Fish and Wildlife Service estimated that humans caused the deaths of 196 million birds per year which represented only 1.9% of the total waterfowl population in the Continental United States. Hunting accounted for 61%, collision with man-made objects (TV towers etc.) 32% and pollution 2%, with other, more obscure categories accounting for 1%. Since the 1980s, the annual harvest has remained below 10 million due to restrictive practices (i.e. bag limits) and lower populations.

Death due to epizootics is often on a large scale; for example, in the 1970s a Health Research Centre in Wisconsin recorded the deaths of 25,000 to 100,000 waterfowl and mass deaths of 5,000 to 10,000 were commonplace. Disease may now kill millions of birds each year and the problem has expanded in both geography and severity during the last 25 years. Without extensive monitoring, these mass deaths are often masked by rapid removal by predators, as in Missouri in 1980-81 when of 4,165 carcasses located, having died from non-hunting causes, only 934 were intact, the remainder having been partly eaten by scavengers. Of the intact carcasses, which were monitored daily, 44% disappeared after day 1, 68% by day 2, 79% by day 3 and 82% by day 4. This answers the question asked of me recently by a wildfowling friend when discussing the problems of lead shot: 'Why don't we see lots of dead ducks lying around?'

No less than 3,000 tons of lead shot were deposited into the wetlands of North America each year during the 1960s. It is likely that shot which misses its intended quarry ultimately causes the death of very many birds through ingestion and subsequent lead poisoning. It has been shown that those species feeding on hard grains such as maize grind up lead shot in the gizzard much more quickly than those feeding on softer grains and vegetation and are thus adversely affected much more severely. Although an unpopular move with many hunters, the phasing out of lead shot and the introduction of non-toxic alternatives will obviously benefit the waterfowl populations.

Each chapter ends with a list of the literature cited and for Major Wetland Habitats in North America there are no fewer than ten pages of references. The final chapter puts the case for and against hunting and argues convincingly that habitat management aimed in part at providing large duck and goose populations for hunting has benefited many species. Ironically, it is the rarer non-hunted species that are in danger of extinction or severe reduction in their numbers, due in the main to reduction of habitat.

An excellent book, packed with information which is presented in a clear and very readable manner. Anyone interested in the subject, whether at academic level or as someone who simply enjoys watching, or even shooting and eating ducks and geese will find much of interest within its 600 pages.

JRM

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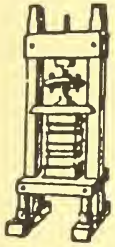

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